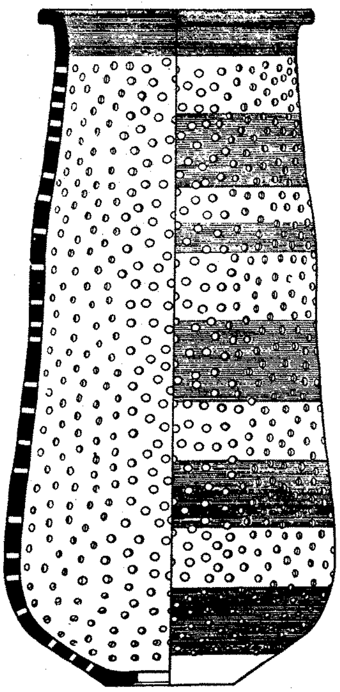
ANCIENT INDIA

Bulletin of the Archaeological Survey of India

Numbers 18 & 19
1962 & 1963



Excavation at Rangpur and other exploration in Gujarat, by S. R. Rao, pages 5-207

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Published by
THE DIRECTOR GENERAL
ARCHAEOLOGICAL SURVEY OF INDIA
NEW DELHI
1963

Part 2

EXCAVATION AT RANGPUR AND OTHER EXPLORATIONS IN GUJARAT

By S. R. Rao

WITH CONTRIBUTIONS BY DR. B. B. LAL, BHOLA NATH, S. S. GHOSH & KRISHNA LAL

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M. OTHER FINDS

(i) *Terracotta figurines*

ANIMAL FIGURINES.—Terracotta figurines are the poor man's sculpture. As cult-objects they sometimes throw light on the religious beliefs and social customs of their age. While some of the figurines of Rangpur are crudely worked, better examples of the art in the round are not totally lacking. On the whole, what we witness in Periods II A and II B is a decadent art of modelling unlike Lothal, where the art maintained a high standard throughout. The figurines from Periods II C and III have retained the sharpness of lines more than those of Period II A, since the latter suffered due to waterlogging. The pellet eyes, where they existed, have fallen off. But there is no applied decoration in the form of collar-bands and neck-laces in the case of animal figurines. Figurines with movable heads are rare, a solitary specimen coming from Period II C. But the most significant animal figurines are two undoubted specimens of the horse from Period III (fig. 50; pl. XXX A, *3*). The horse was known in the fourth Phase of Lothal A, as well as in Lothal B. It was known in the last days of Mohenjo-daro also.[1]

Finely-levigated clay was used for making terracotta animal figures. They are generally hand-modelled and baked to a dull-red colour in Period II A and to grey or pink

[1] Wheeler, *op. cit.* (1960), p. 65.

5-9. These sherds have nearly the same characteristics as described above, but sample 9 has a dark-red ochrewash fairly thickly applied so that the concentric striations, characteristic of other sherds, have been obliterated. It would, therefore, be appropriate to describe it as an ochre-coloured slip rather than a wash. The chocolate-black colour used in decorating the ware shows the presence of manganese and iron and may have been prepared from a manganiferous ore.

10. This sherd is reddish in section and there is no evidence of any grey zone. It is a well-fired and oxidized ware and was given a wash of red ochre. The striations are clearly visible.

11. This sherd is very similar to sample 8. Here the ochre-wash is fairly thick on the inner side, but the exterior convex surface shows a thinner layer. The nature of clay and the method of firing are the same as in the above samples.

12. This sherd shows a buff colour in section without any perceptible grey zone. The colourwash is much thinner than in samples 9 and 11. The thin wash has nearly flaked off on the exterior, but traces of a dark-chocolate band are noticeable at the rim. There is little adhesion between the body and the dark colour which shows that the decoration was post-firing.

13. Both the surfaces are finished and decorated. The inner surface carries a fine slip of reddish colour; the outer surface is yellowish-buff. It seems that red-ochre wash was applied to the interior and a yellow-ochre wash to the exterior. The sherd shows a pinkish buff colour in section. The sherd was fired well in an oxidizing atmosphere and then decorated.

14. This sherd is similar to sample 13. Light-red on the interior and yellowish-buff on the exterior, it is painted in chocolate colour like that sample. In section it is buffish-pink in colour. It is a well-fired and oxidized pot. It gives a marked metallic ring when struck.

15 and 16. These are similar to samples 13 and 14. Sample 16 shows a fairly-thick dark-red slip which has largely obscured the striations caused in turning the pot on the wheel. This ochrewash is not so thick as sample 15. The outer surface of sample 16 is yellowish buff, but sample 15 does not show any yellow tinge on the exterior. The body of sample 16 is, however, coarser than that of 15.

17. A thick sherd showing a thick reddish slip on the interior and a buff slip on the exterior. The surface was decorated by a deep ochre-red wash which has largely flaked off, showing the inner buff slip. The pot was evidently well-fired in an oxidizing atmosphere.

From the above it will be observed that except for some slight difference in colour or shade, samples 1-12 show the same technique of firing and decoration, but samples 13-16 reveal a new technique totally absent in the former group.

Buff ware.—There are six sherds (samples 18-23) of a yellowish-buff colour. All are made of a calcareous clay which is rather coarse when compared with that used in samples 1-17. However, they emit a metallic ring when struck and are well-fired. Samples 18, 19 and 21 are about 1·3 to 1·4 cm. thick and sample 20 about 1·0 cm. The remaining two samples, 22 and 23, are thinner and are made of finer clay. In section, samples 18, 19 and 21 show a yellowish-buff colour. Sample 22, however, shows two distinct zones, a yellowish inner zone about 2 mm. thick and greyish buff outer zone about 0·8 mm. thick. Samples 22 and 23 are about 0·4 to 0·6 cm. thick and show a buff colour in section. They are as hard in surface-hardness as the red ware sherds. It seems that a finely-levigated clay of the same composition as the body but free from sand was applied

to both the surfaces of these pots before firing. Samples 22 and 23 have a chocolate banded decoration; the colour is due to iron and manganese. It seems that a manganiferous ore was used for preparing the pigment.

In view of their hardness, which ranges between 5 and 6, and the absence of any distinctly grey or black core even in the thick sherds, it appears that ordinary oxidizing atmosphere was used in firing these pots. Due to the presence of lime the red colour of oxidized iron did not develop and the clay burnt to a buffish-yellow colour. There is no doubt that this yellowish-buff ware shows a marked difference from the red ware already described.

These sherds were subjected to pyrometric test. They were exposed to strong heat (700°–800° C.) in open air, but in spite of prolonged heating for several hours, none of them developed the characteristic ochre-red or pink colour of ordinary ferruginous clay fired in oxidizing atmosphere. The absence of red colour is therefore attributable to the calcareous nature of the clay used in making these pots.

Grey ware.—One sherd, sample 24, was received for examination. The body of the sherd is grey; the clay is coarser than that in the samples described above. The surface shows a thin layer of greyish-black slip which was evidently applied to the pot to render it smooth. It was subsequently polished and fired in a reducing atmosphere. In the absence of a larger number of sherds of this ware, it is difficult to say anything more regarding the exact techniques of manufacture and firing and much reliance should not, therefore, be placed on the results of examination.

Period II B

Nine sherds, samples 25-33, from RGP 2 and RGP 5 were examined and analysed. Six of them, samples 25-30, can be classified as red ware and the remaining three, 31-33, as buff ware.

Red ware.—The results of the examination of the six sherds are given below.

25. This sherd, about 1·4-1·5 cm. thick, is reddish in section and shows a yellowish-buff slip on the interior. The latter has little covering-power and all the striations of the the wheel are quite clearly visible. It shows a marked similarity to sample 16; the fabric is almost identical and so is the nature of the slip and wash. It has been well-fired in an oxidizing atmosphere and is quite hard (about 5-6). It emits a marked metallic ring when struck. Coarse to fine sand was used as a dégrassiant and the pot was turned on the wheel.

26. It is a finely-slipped reddish sherd; both the surfaces have been finished with a deep-red slip. Decorative paintings apart, it is similar to sample 9, particularly if the dark-red slip is taken as a guide. The nature of firing was also similar. In fact, this sherd can be grouped technically under red ware of Period II A.

27. This sherd is reddish in colour; the finish of the exterior surface has evidently been destroyed as a result of weathering. It is about 0·5 cm. thick and shows two zones in section, a deep-red exterior zone of about 2 mm. thickness and brownish-red inner zone of 3 mm. thickness. An examination of the body shows that in composition it is similar to sample 1, and surface-hardness is about the same, viz., 5-6. This pot was fired in an oxidizing atmosphere.

28. This sherd has been described as red ware of degenerate fabric. When compared with sample 2, it is observed that these two sherds are almost alike in colour, nature of ochrewash and hardness. They seem to have been fired to almost the same range of temperature. In section, the present sample shows a reddish outer and inner zone

with a faintly-reddish inner zone. Its body-material is, however, slightly coarser than that sample 2, but the technique of potting, finishing and firing does not show any variation.

29. This sherd, about 1·5 cm. thick, has been well-fired in an oxidizing atmosphere. Its surface-hardness is 5-6. It carries a slip of pale-yellow or buff colour on its outer surface, subsequently painted dark-ochre red. The interior surface is also treated with a thin slip. The section shows a distinct yellowish-buff outer zone of about 1 mm. thickness and a buff inner zone of the same thickness. The central zone, about 1·3 cm. thick, is brick-red. It bears some resemblance in colour and texture to sample 3.

30. This sample, about 1·3-1·4 cm. thick, is coarser than sample 29, but the conditions of firing appear to have been similar. It is well-fired in an oxidizing atmosphere and emits a marked metallic ring. The inner surface is also painted in red about 3 in. below the rim and presents an outward appearance similar to sample 29. Due to weathering, not much can be said about the nature of its surface-finish and it would be desirable to examine a larger number of sherds of this type before final conclusions about any change in the technique of manufacture or methods of firing can safely be drawn.

BUFF WARE.—Three sherds of buff ware were examined.

31. It has a slip and painting, the latter having disappeared due to weathering. The sample is very similar in texture and colour to samples 18-23. In chemical composition again, it shows a close similarity to the sherds of buff ware belonging to Period II A. It has a calcareous clay fired in an oxidizing atmosphere. It compares favourably with sherds of red ware in surface-hardness and metallic ring.

32. It is similar to the above but is slightly better-finished. It is made of a calcareous clay and has been well-fired in an oxidizing atmosphere.

33. It is painted in black over a chocolate slip. An examination of the sherd in section shows three zones; the two outer zones are reddish and the middle one greyish-buff. The inner surface is buff but is different in colour from samples 18-23. However, this sherd is different from the other sherds of this group, viz. 31 and 32, and it would not be desirable to class it with them.

PERIOD II C

Six sherds, all in red ware, from RGP 2 and RGP 5 were examined with the following results.

34. It is a shining red sherd made of fine clay. The surface is rendered smooth by burnishing and given a slip of finely-levigated red ochre. It is also probable that in its green state the pot was subjected to burnishing with pebbles of haematite, which left a fine powder of iron oxide securely adhering to the surface. The pot was then fired in an oxidizing atmosphere. The decoration in red was evidently post-firing, as the black pigment does not show any evidence of sintering and does not stick firmly to the red surface. Its texture is slightly coarse, similar to that of samples 28 and 30.

35-36. The above remarks apply equally to samples 35 and 36, although the clay used in making 36 is coarser than that in 34 and 35.

37. The sherd is about 1 cm. thick and is with a coarse texture. In section, it shows three distinct zones, the outer reddish zone about 3 mm. thick, the inner reddish zone about 3 mm. thick and a greyish black central zone 4 mm. thick. The outer surface is ochrewashed and painted in black colour The inner surface does not carry any wash, slip or decoration In finish, colour, wash and decoration of the outer surface, the sample resembles samples 3, 4 and 7, but the texture of the body is slightly coarser.

38. This is a reddish sherd of about 1 cm. thickness. In section, it shows three distinct zones, the outer reddish zone of 2 mm. thickness, the inner reddish zone of about 2 mm. thickness and middle greyish-buff zone of about 6 mm. thickness. The exterior has a slip of deep red-ochre colour as well as pale-yellow colour similar to that noted on sample 16. The inner surface is treated with a yellowish-buff slip.

39. It is a coarsely-made pot. The outer and inner surfaces are deep-red with a smoky-grey core which is best seen in section. There is no evidence of burnishing but an ochre-wash or slip was applied to the pot before painting in black.

PERIOD III

Eight sherds from RGP-2 and RGP-5 were examined.

40. The sample shows a lustrous surface. The pot was evidently burnished with a burnisher such as a pebble or a piece of haematite.

41. It shows a very faint lustre. It is painted in black over red. Its texture is quite fine, distinctly finer than that of sample 40.

42. It shows a lustrous red outer surface painted in black; the inner surface is buff. Its texture is fairly fine.

43. It is rather coarse in texture, but on both surfaces it carries a marked lustre and clear evidence of burnishing.

44-46. The above remarks apply equally to samples 45 and 46, but sample 44 shows only a lustrous outer surface, the inner surface being left untreated.

47. It is about 1·2 cm. thick and is very coarse in texture. It shows a burnished outer surface with a faint lustre; the inner surface has evidently lost its lustre and finish due to weathering.

M. OTHER FINDS

(i) *Terracotta figurines*

ANIMAL FIGURINES.—Terracotta figurines are the poor man's sculpture. As cult-objects they sometimes throw light on the religious beliefs and social customs of their age. While some of the figurines of Rangpur are crudely worked, better examples of the art in the round are not totally lacking. On the whole, what we witness in Periods II A and II B is a decadent art of modelling unlike Lothal, where the art maintained a high standard throughout. The figurines from Periods II C and III have retained the sharpness of lines more than those of Period II A, since the latter suffered due to waterlogging. The pellet eyes, where they existed, have fallen off. But there is no applied decoration in the form of collar-bands and neck-laces in the case of animal figurines. Figurines with movable heads are rare, a solitary specimen coming from Period II C. But the most significant animal figurines are two undoubted specimens of the horse from Period III (fig. 50; pl. XXX A, *3*). The horse was known in the fourth Phase of Lothal A, as well as in Lothal B. It was known in the last days of Mohenjo-daro also.[1]

Finely-levigated clay was used for making terracotta animal figures. They are generally hand-modelled and baked to a dull-red colour in Period II A and to grey or pink

[1] Wheeler, *op. cit.* (1960), p. 65.

FIG. 50. *Terracotta horses, Period III*

colour in Periods II C and III. On the other hand, the figurines from Period III are decorated with painting or burnishing after the application of a deep-red slip. A painted terracotta animal figure came from Ghurye's excavation, while painted terracotta animal-horns have been found in the present excavation (pl. XXXI A, *6*); both of them suggest that animal figures were occasionally painted directly on the unslipped surface. Incised nail-punch decoration was also adopted but rarely. 'Bird-whistles' are among the important finds in Period III (pl. XXX B, *1*). They have the shape of a hen as in Chanhu-daro bird-whistles from the Harappan levels.[1] Whereas the latter have a pedestal-base and two holes, the Rangpur examples have only one hole near the tail but no pedestal-base. The whistles from Harappa have two holes.

On the animal figurines a slip was applied and their surface was burnished in Periods II C and III so that they were smooth and lustrous. There was also a vigour in the art of modelling as suggested by the majestically-standing figurines of humped and humpless bulls. Bulls with 'x'-shaped horns and with raised head painted on vessels remind us of the present Kankrej bulls of Kathiawar. They may indicate a breed different from the earlier ones. Among other animals, the horse with pricked ears and wide nostrils may be noted (pl. XXX A, *4*). Unfortunately the figures are damaged, but in one case even the mane is clear. The following table shows the Period-wise distribution of animal figurines.

PERIOD	BULL	DOG	HORSE	UNIDENTIFIED	TOTAL
II A	2	..	..	..	2
II B	..	..	..	1	1
II C	1	1	..	3	5
III	17	1	2	6	26

Pl. XXX A

1. Bull; humpless; short legs and ears; tail and horns visible; dull-red fabric. From Period II A. (No. 262.)

2. Unidentified; tail damaged; hind legs and groove for fixing the head visible; dull-red fabric. From Period II C. (No. 137.)

[1] Mackay, *op. cit.* (1943), p. 167.

3. Horse; only head visible; muzzle mutilated; mane indicated by an indented line; dull-red fabric. From Period III. (No. 334.) Fig. 50, left.

4. Horse; head with pricked ear; muzzle partially visible; deeply-incised nostrils; smoky core but surface smooth. From Period III. (No. 32.) Fig. 50, right.

5. Bull; horns, muzzle and ears visible; tail damaged; dull-red fabric. From Period III. (No. 213.)

6. Bull; humpless; hind legs and tail visible; head and forelegs missing; dull-red fabric. From Period III. (No. 255.)

Pl. XXX B

1. Bull; humped; head, tail and legs damaged; decorated with nail-punch marks all over the body; grey colour. From Period III. (No. 26.)

2. Bull; humped; short legs, head and tail mutilated; ill-fired; grey colour. From Period III. (No. 62.)

3. Bull; humped; head raised as if standing majestically; short hind legs and tails visible; horns and forelegs mutilated; brown colour. From Period III. (No. 529.)

4. Bull; humped; short hind legs, front legs broken; head missing; grey colour. From Period III. (No. 550.)

5. Dog; long snout; ears, legs and hind parts mutilated; grey colour. From Period III. (No. 603.)

6. Bull; humped; head raised as if majestically standing; horns extended sideways; short and flattish muzzle; tail missing; core reddish. From Period III. (No. 528.)

(ii) *Miscellaneous terracotta objects*

Miscellaneous terracotta objects include horns, bird-whistles, marbles, tabloids, beads and a miniature cart-frame.

HORNS.—Mention has already been made of horns of terracotta animals. Out of nine horns found in the excavation, one from Period III is painted in black over red. The rest are plain and come from Periods II C and III. One of them represents the horn of a stag (pl. XXXI A, *4*).

BIRD-WHISTLES.—Three peculiar bird-like terracotta objects used as whistles have been found. Two of them are very well burnished and have a lustrous tan colour. One of them is broken. They are formed by joining two halves moulded separately. Bird-whistles from the Harappan levels of Chanhu-daro and from Harappa itself have been referred to above (p. 138).

Two of the bird-whistles of Rangpur come from Period III and one from Period II C.

LEG OF HUMAN FIGURINE.—The leg of a human figurine in terracotta is the only evidence of human figurines having been in use in Rangpur III. It has a lustrous red slip and is broken near the knee-cap.

MARBLES.—Spherical terracotta marbles of various sizes are found throughout the Harappan and later levels.

TABLOID.—A rectangular tabloid found in Period II A is analogous in shape and size to the tabloids from Lothal, Mohenjo-daro, Harappa and Chanhu-daro.

TOY-CART.—A miniature cart-frame with holes for inserting sticks gives an idea of the type of carts in use in Period II C.

Pl. XXXI A

1. Unidentified object; tabloid; circular; may be an unfinished cart-wheel. From Period III. (No. 613.)
2. Bird-whistle with perforation; burnished; red. From Period III. (No. 333.)
3. Bird-whistle; grey; damaged. From Period III. (No. 398.)
4. Horn of stag; burnished; red. From Period III. (No. 5.)
5. Horn of bull; red-washed. From Period III. (No. 117.)
6. Horn of bull; painted in black over red. From Period II B. (No. 604.)
7. Horn of bull; buff-washed. From Period II C. (No. 553.)
8. Leg of a human figure; foot also partially visible; lustrous red slip. From Period III. (No. 555.)
9. Toy cart-frame with axial hole and vertical perforations for fixing poles. From Period II C. (No. 618.)
10. Unidentified object; tabloid; rectangular. From Period II A. (No. 283.)
11. Marble; spherical. From Period III. (No. 21.)
12. Marble; spheroid. From Period III. (No. 218.)
13. Marble; spheroid. From Period III. (No. 239.)

TRIANGULAR CAKES (pl. XXXI B).—Triangular terracotta cakes of various sizes, with pointed or truncated corners, were found in large numbers in Period II A, but were very few in Period II B. They are peculiar to all Harappan sites. The use to which they were put is not yet known. They are often found in fire-places and ash-pits at Lothal. Ovoid balls with finger-marks and triangular cakes were found along with ash and burnt earth in a rectangular structure of kiln-burnt bricks close to which a beautifully-painted jar was found at Lothal. A ritualistic use attributed to them by some scholars may not therefore be ruled out. These cakes are too rough to be used as flesh-rubbers. Some of them are stamped with designs of intersecting circles.

EAR-ORNAMENTS, WHORLS, WHEELS AND BEADS.—Terracotta beads of various shapes were in use in all Phases but they were most popular in Period III.[1] Pear-shaped beads with a flat top and bottom and barrel-shaped beads with raised edges were common types. At least some of these beads are similar to spindle-whorls.

FIG. 51

1. Bead or whorl, short truncated bicone; circular; incised horizontal strokes within two parallel lines on both the sides. From late level of Period II A. Pl. XXXII A, *1.* (No. 423.)
2. Bead, short truncated barrel circular. From mid-level of Period III. Pl. XXXII A, *2.* (No. 561.)
3. Bead short truncated pear-shaped circular, having a black band on a red slip and four dots. From a mid-level of Period III. Pl. XXXII A, *3.* (No. 534.)
4. Bead; short truncated pear-shaped circular. From late level of Period II A. Pl. XXXII A, *4.* (No. 519.)
5. Bead, short vase-shaped circular, having a red slip. From mid-level of Period II C. Pl. XXXII A, *5.* (No. 203.)

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[1] Two terracottas beads occurred in Period II A, seven in II B, thirty in II C and thirtyfive in III.

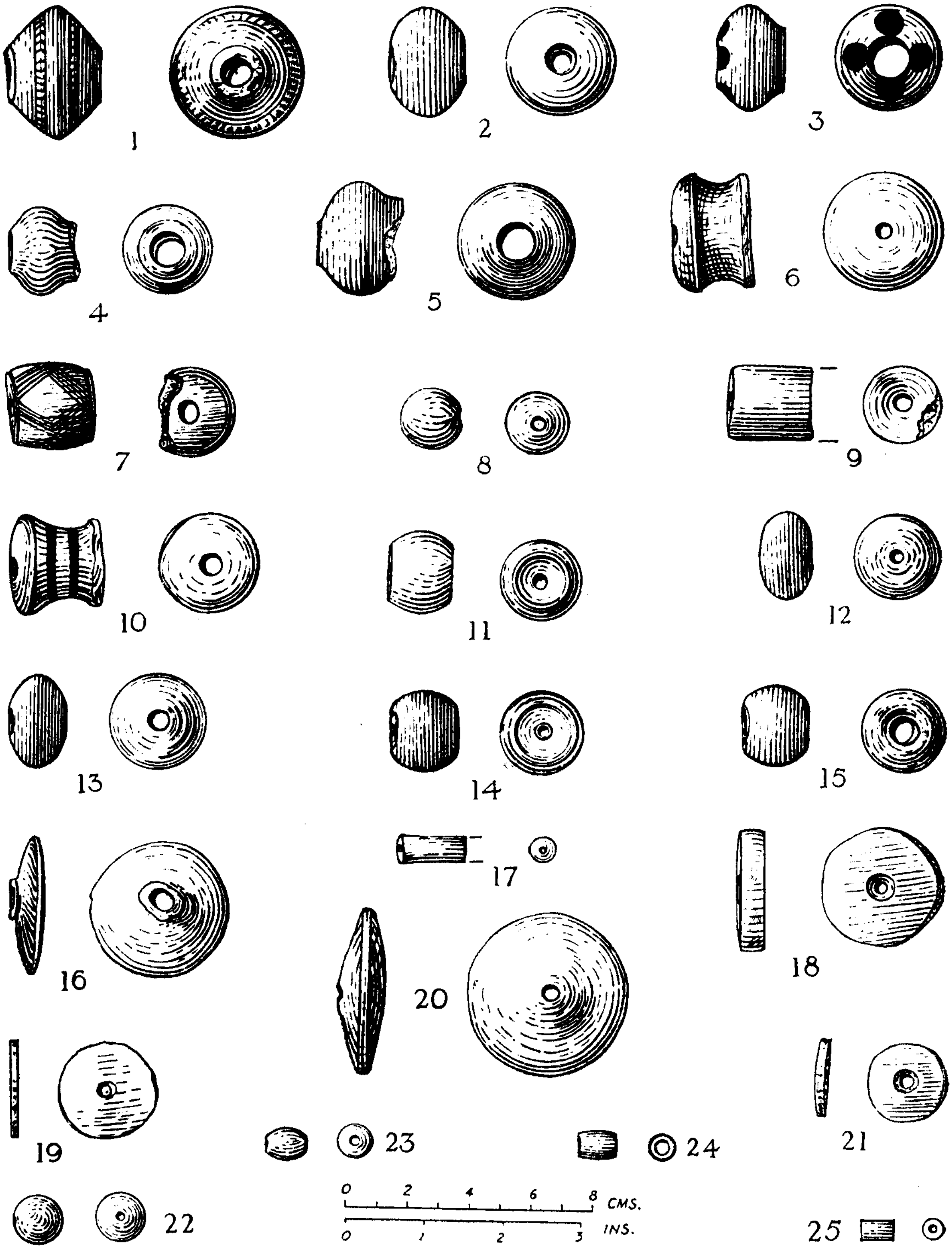

FIG. 51. *Terracotta ear-ornaments, whorls and beads*

6. Bead or ear-ornament, short with plano-convex sides and concavo-circular section; pulley-like. From early level of Period III. Pl. XXXII A, *6.* (No. 411.)

7. Bead, short truncated barrel circular, fragmentary, with yellow wash and incised row of lozenges. From late level of Period II A. Pl. XXXII A, *7.* (No. 654.)

8. Bead, standard spheroid. From late level of Period III. Pl. XXXII A, *8.* (No. 522.)

9. Bead, long cylindrical slightly biconcave-circular. From early level of Period II C. Pl. XXXII A, *9.* (No. 634.)

10. Bead or ear-ornament, long biconvex-sided concave-circular pulley-like; dull-red slip; painted with two parallel circular bands in chocolate. From late level of Period II B. Pl. XXXII A, *10.* (No. 602.)

11. Bead, short truncated barrel biconcave circular. From late level of Period II B. Pl. XXXII A, *11.* (No. 504.)

12. Bead, short barrel circular. From late level of Period II C. Pl. XXXII A, *12.* (No. 470.)

13. Bead, short truncated bicone circular. From late level of Period III. Pl. XXXII A, *13.* (No. 158.)

14. Bead or whorl, short truncated barrel biconcave circular. From late level of Period III. Pl. XXXII A, *14.* (No. 545.)

15. Bead, short truncated barrel circular. From late level of Period II B. Pl. XXXII A, *15* (No. 471.)

16. Cart-wheel with a plano-convex section having a hub. From early level of Period II C. Pl. XXXII B, *1.* (No. 462.)

17. Bead, long cylindrical circular. From late level of Period II A. Pl. XXXII B, *2.* (No. 310.)

18. Cart-wheel, made from a potsherd. From late level of Period II A. Pl. XXXII B, *3.* (No. 247.)

19. Cart-wheel, made from a potsherd. From early level of Period II B. Pl. XXXII B, *4.* (No. 597.)

20. Cart-wheel, biconvex circular. From early level of Period II A. Pl. XXXII B, *5.* (No. 607.)

21. Cart-wheel, concavo-convex circular. From late level of Period III. Pl. XXXII B, *6.* (No. 64.)

22. Bead, standard slightly truncated bicone, circular, red slip. From late level of Period III. Pl. XXXII B, *7.* (No. 536.)

23. Bead, long truncated bicone circular, red slip. From an unstratified level. Pl. XXXII B, *8.* (No. 453.)

24. Bead, long barrel circular, red slip. From late level of Period III. Pl. XXXII B, *9.* (No. 554.)

25. Bead, long cylindrical circular, red slip. From early level of Period II B. Pl. XXXII B, *10.* (No. 537.)

(iii) *Beads*

Beads are the most prolific among the personal ornaments of the Harappans and their successors and are known for variety of shapes and material used. Those of terracotta have been dealt with above.

Whereas the early Harappan settlers of Rangpur had preference for beads made of faïence, steatite, gold and semi-precious stones such as carnelian, jasper and agate, their successors used mostly shell and terracotta beads. Typologically speaking, disk, cylindrical

and lenticular types were popular in Period II A, whereas biconical, truncated and cylindrical types were commonly used in Period III. The following table shows the distribution of beads according to material and Periods.

Period		Steatite	Faience	Gold	Carne-lian	Jasper	Agate	Shell	Ivory
II A	..	4916	73	5	1	2	1	6	2
II B	..	5	5	2	2	1	1	5	2
II C	..	3	3	1	2	2	1	16	0
III	..	2	4	0	3	1	1	11	0

Thin disk beads of gold and steatite and lenticular beads of banded agate, shell and ivory are characteristic of the Harappa culture. To this group may be added the cylindrical beads, also known as tubular beads. They are mostly of faïence, steatite and carnelian. A few of these continued to be used in Period II B. On the other hand, truncated biconical and barrel beads of shell and terracotta were commonly used in Period II C and possibly later too. A small jar containing more than four thousand and nine hundred tubular microbeads made of steatite was found in a room of a mud-brick house of Phase II in RGP 4. These beads are a special feature of the Harappa and late Harappa periods. The process of manufacturing these beads appears to have been as follows. Long cylinders of steatite and faïence were prepared by rolling the paste on a thread. After baking they were cut to size with a fine saw. Saw-marks are seen on partially-cut faïence cylindrical beads. Similar marks are also visible on an extremely thin disk bead of steatite, indicating thereby the use of a very delicate instrument for cutting.

Mention should also be made here of a cylindrical object of crystal with gold-filling. It is imperfectly perforated and the gold filling in the depression suggests that it was not used as a bead. Another extraordinary find is a barrel bead of black agate so highly polished that reflection can be seen on it (pl. XXXIV A, *3*). The use of jasper of variegated colours is confined to Periods II A, II B and II C. Carnelian beads were in limited use and only one specimen of the long cylindrical type has been found at Rangpur in Period II A. But small biconical carnelian beads and truncated barrel types are recovered from later levels also. White amonitis (tubular shell) was used as a bead in Period II A.

Small gold beads are frequently collected from the mound by the local inhabitants, who call them *jīni-pāri*. A few were found during the excavation also. Disk and tubular types of gold beads come from the Harappan levels. A biconical bead of leaf-design with an axial hole is an interesting specimen from Period II A. Five gold beads were found in Period II A, two in II B and one in II C, but none in III.

Fig. 52; pl. XXXIV A

1. Banded agate; standard lenticular. From late level of Period II C. (No. 104.)

2. Variegated agate; long truncated bicone circular. From late level of Period III. (No. 421.)

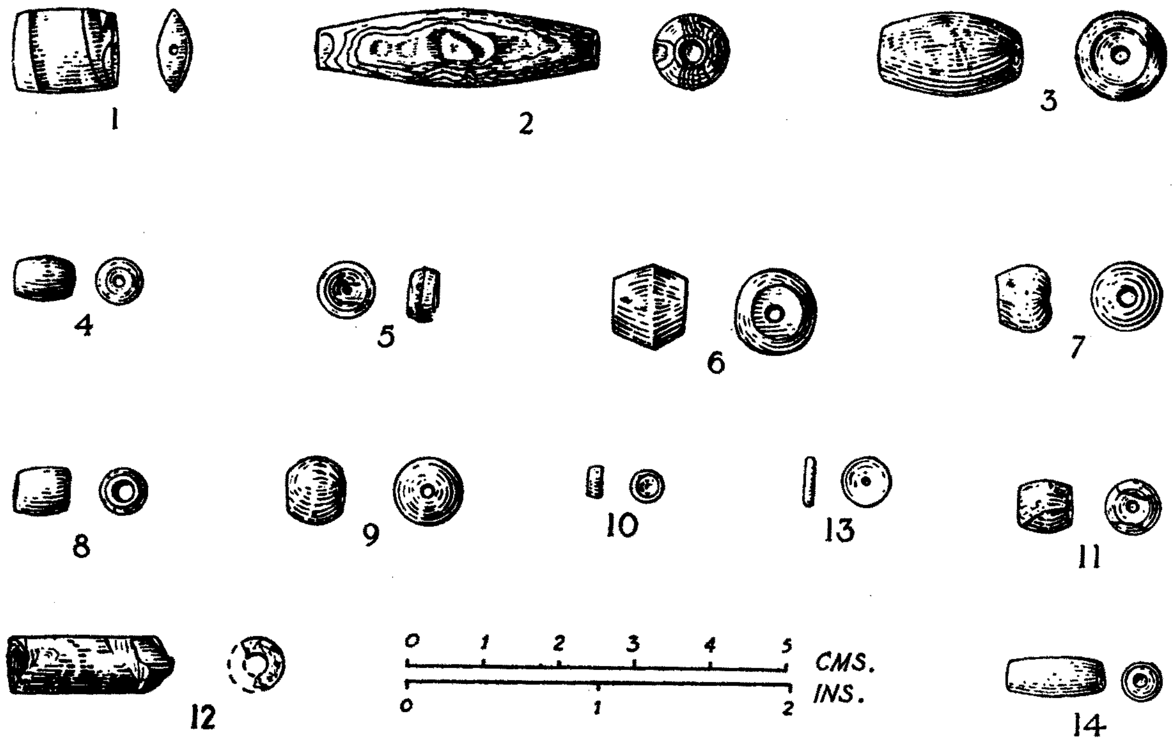

FIG. 52. *Beads*

3. Black jasper; long truncated barrel circular; highly polished. From late level of Period II A. (No. 45.)

4. Red jasper; long truncated bicone circular. From late level of Period III. (No. 245.)

5. Crystal; short plano-concavo circular roughly bicone double perforated. From late level of Period III. (No. 500.)

6. Bone; short truncated bicone roughly circular. From late level of Period II C. (No. 110.)

7. Chalcedony; short truncated on one side pear-shaped circular. From late level of Period II B. (No. 258.)

8. Yellow jasper; long roughly barrel circular. From late level of Period III. (No. 478.)

9. Carnelian; short truncated barrel circular. From mid-level of Period III. (No. 385.)

10. Carnelian; short barrel circular. From early level of Period II B. (No. 633.)

11. Carnelian; standard truncated barrel circular. From late level of Period II C. (No. 390.)

12. Carnelian; long cylindrical circular. Broken. From mid-level of Period III. (No. 356.)

13. Red jasper; short truncated barrel, circular disk. From mid-level of Period III. (No. 527.)

14. Jasper; long truncated barrel circular. From late level of Period II A. (No. 264.)

Fig. 53

1. Shell; short truncated bicone circular. Additional oblique perforation. From late level of Period II A. Pl. XXXIII, *1*. (No. 252.)

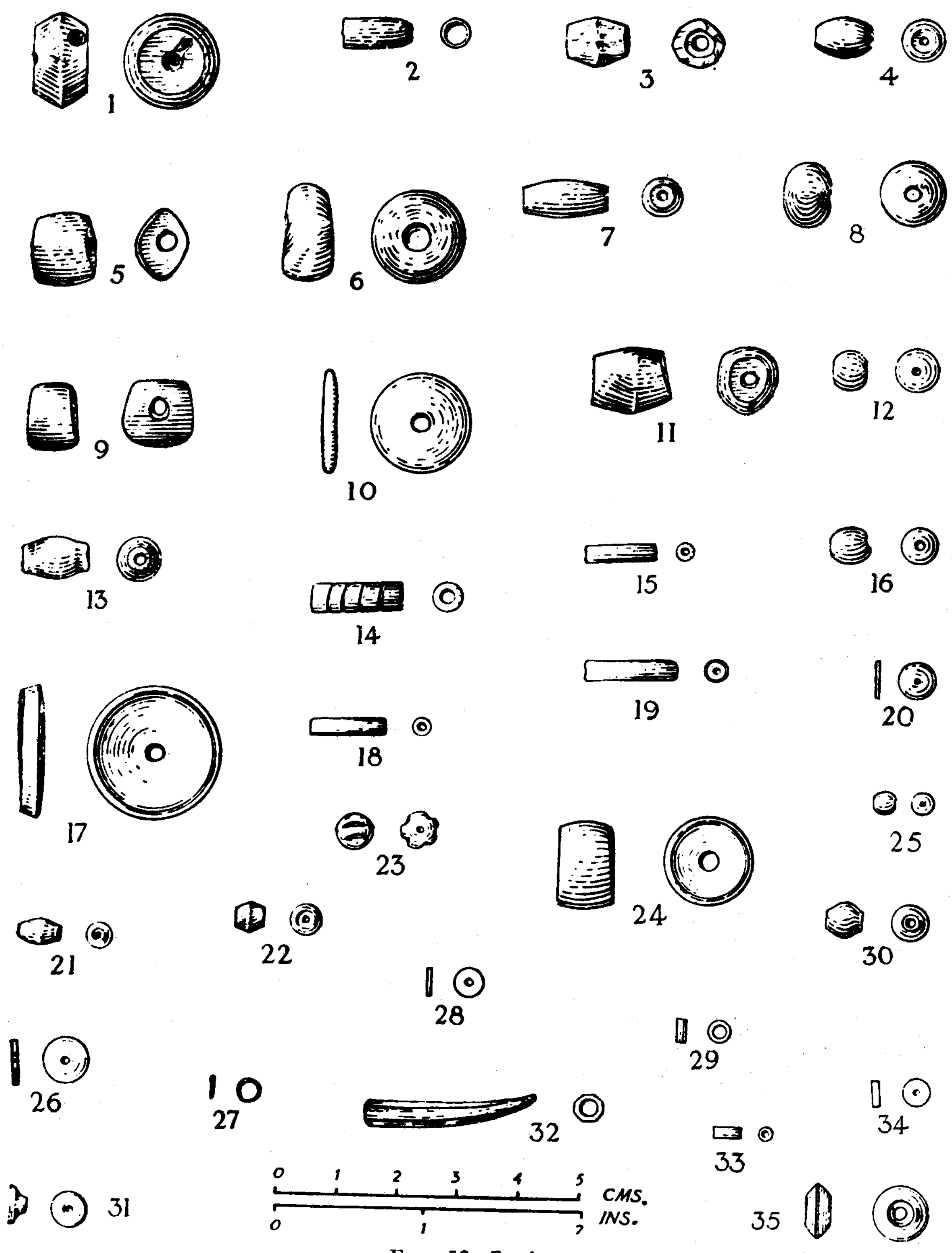
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FIG. 53. *Beads*

2. Shell; long barrel circular. From mid-level of Period II A. Pl. XXXIII, *11.* (No. 291.)

3. Shell; long truncated bicone roughly circular. From mid-level of Period III. Pl. XXXIII, *3.* (No. 579.)

4. Faïence; long truncated barrel circular. From late level of Period II C. Pl. XXXIII, *4.* (No. 119.)

5. Shell; short barrel lenticular. From late level of Period II C. Pl. XXXIII, *5.* (No. 44.)

6. Shell; short truncated roughly barrel circular. From mid-level of Period II B. Pl. XXXIII, *6.* (No. 632.)

7. Faïence; long truncated barrel circular. From mid-level of Period II A. Pl. XXXIII, *7.* (No. 117.)

8. Faïence; short spheroid circular. From early level of Period III. Pl. XXXIII, *12.* (No. 609.)

9. Shell; standard biconvex plano-convex. From late level of Period II A. Pl. XXXIII, *9.* (No. 140.)

10. Steatite; truncated cylindrical disk. From late level of Period III. Pl. XXXIII, *10.* (No. 351.)

11. Shell; long truncated bicone roughly oblong. From mid-level of Period III. Pl. XXXIII, *11.* (No. 399.)

12. Faïence; short truncated barrel circular. From mid-level of Period III. Pl. XXXIII, *8.* (No. 574.)

13. Faïence; long truncated barrel circular. From late level of Period II A. Pl. XXXIII, *13.* (No. 36.)

14. Faïence; long cylindrical circular segmented. From mid-level of Period II A. Pl. XXXIII, *14.* (No. 304.)

15. Faïence; long cylindrical circular. From late level of Period II A. Pl. XXXIII, *15.* (No. 254.)

16. Steatite; standard barrel circular. From late level of Period III. Pl. XXXIII, *16.* (No. 521.)

17. Shell; short convex cone disk circular. From late level of Period III. Pl. XXXIII, *17.* (No. 384.)

18. Faïence; long cylindrical circular. From late level of Period II A. Pl. XXXIII, *19.* (No. 210.)

19. Faïence; long cylindrical circular. From late level of Period III. Pl. XXXIII, *20.* (No. 402.)

20. Steatite; short cylindrical circular. From late level of Period II A. Pl. XXXIII, *21.* (No. 208.)

21. Faïence; long truncated bicone circular. From mid-level of Period II B. Pl. XXXIII, *22.* (No. 312.)

22. Shell; standard truncated bicone circular. From mid-level of Period III. Pl. XXXIII, *23.* (No. 399.)

23. Faïence; standard globular circular gadrooned. From mid-level of Period III. Pl. XXXIII, *18.* (No. 375.)

24. Shell; short truncated barrel circular. From late level of Period III. Pl. XXXIII, *24.* (No. 557.)

25. Faïence; standard truncated barrel circular bead. From late level of Period II A. Pl. XXXIII, *25.* (No. 272.)

26. Steatite; short cylindrical disk circular bead. From mid-level of Period II A. Pl. XXXIII, *26.* (No. 263.)

27. Gold; wire. From early level of Period II B. Pl. XXXIII, *33.* (No. 648 A.)

28. Gold; short cylindrical disk circular. From mid-level of Period III. Pl. XXXIII, *28.* (No. 401 A.)

29. Gold; short circular bead. From late level of Period II A. Pl. XXXIII, *34.* (No. 51.)

30. Faïence; standard truncated barrel, circular. From late level of Period II C. Pl. XXXIII, *26.* (No. 196.)

31. Gold; short cylindrical disk circular, with a hub-like protrusion on one side. From late level of Period II A. Pl. XXXIII, *32.* (No. 134.)

32. Amonitis; long horn-shaped hexagonal. From mid-level of Period III. Pl. XXXIII, *35.* (No. 588.)

33. Steatite; long cylindrical circular. From late level of Period II A. Pl. XXXIII, *29.* (No. 296.)

34. Steatite; short cylindrical circular. From late level of Period II A. Pl. XXXIII, *30.* (No. 68.)

35. Gold; short truncated bicone circular. From late level of Period II A. Pl. XXXIII, *31.* (No. 54.)

(iv) *Stone objects*

Querns, mullers, etc.—Querns and mullers of sandstone and schist have been found at all the levels. The roughly-hewn undersurface of the querns suggests that they were fixed to the floor of the house. In one of the houses of Phase IV in RGP 4, one quern, four mullers and two spheroid weights of sandstone were found. The undersurface of the mullers is smooth owing to use; there are also examples with both the surfaces rendered smooth. The mullers are plano-convex and triangular or slightly ovoid in section and the material generally used is sandstone and rarely schist or trap.

Pl. XXXVI A

Quern and muller; sandstone. From Period II A.

Pl. XXXVI B

1. Muller; sandstone; rectangular plano-convex. From Period III. (No. 25.)
2. Muller; sandstone; rectangular roughly plano-convex. From Period II A. (No. 9.)
3. Muller; sandstone; ovoid rectangular. From Period III. (No. 8.)
4. Muller; sandstone; rectangular ovoid. From Period II C. (No. 5.)
5. Muller; sandstone; discoid lenticular. From Period II A. (No. 10.)
6. Muller; sandstone; ovoid plano-convex. From Period II A. (No. 7.)
7. Muller; sandstone; ovoid rectangular. From Period III. (No. 6.)
8. Muller; schist; ovoid roughly biconvex. From Period III. (No. 4.)

Weights.—A uniform system of weights was prevalent throughout the Indus valley. Apparently the Rangpur people also followed the same system in Period II A. The two cubical weights of agate found at Rangpur, weighing 13·286 gr. and 13·470 gr. respectively, conform to the standard obtaining at Lothal. Spheroid or elliptical weights of larger size in dolerite were also in use at Harappa, Lothal and Rangpur II A and continued to be used exclusively in Lothal B and Rangpur II C and III. Four such weights with flat top and bottom have been recovered in the present excavation.

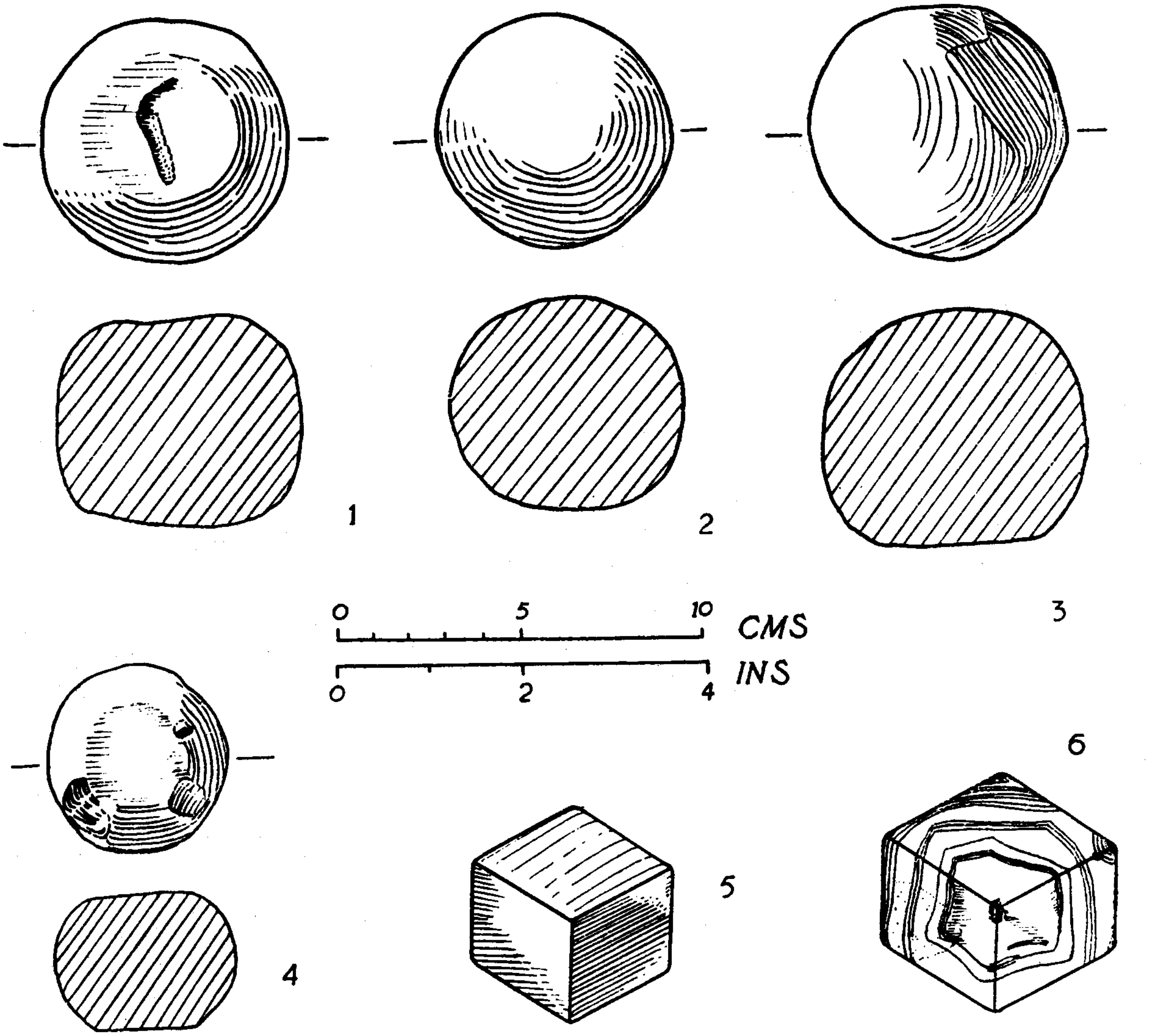

FIG. 54. *Stone weights*

Fig. 54

1. Fine-grained dolerite; circular rectangular. Weight 46·766 gr. From Period II C. (No. 11.)
2. Doleritic rock; circular ovoid. Weight 26·611 gr. From Period II C. (No. 22.)
3. Altered granitic rock; circular elliptical. Weight 58·126 gr. From Period III. (No. 538.)
4. Aplitic rock; circular elliptical. Weight 12·767 gr. From Period III. (No. 21.)
5. Black crypto-crystalline variety of silica; cuboid. Weight 13·286 gr. From Period II A. Pl. XXXIV C. (No. 1993.)
6. White banded agate: cuboid. Weight 13·470 gr. From Period II A. Pl. XXXIV C. (No. 1099.)

(v) *Shell objects*

Shell was used for making bangles, spoons, beads and gamesmen and for inlay-work. Out of thirtythree shell bangles recovered from the excavations, only two come from Period II C and the rest from Period II A. Rejected cores and columella recovered from Period II A levels (pl. XXXVII B) suggest a local shell-industry. Shell, as a more durable material, was preferred to terracotta for making bangles in Period II A. In type, they are generally plano-convex in section and occasionally have a mid-ridge. The decoration consists of two incised lines meeting each other at an acute angle. Besides bangles, there are a few circular perforated tabloid pieces of shell which might have been used for inlay. Other perforated pieces were used as pendants. A rim of a vessel in shell is of particular importance. Shell objects were more frequently used at Lothal, where gaming pieces, engravers, etc., have been found.

Pl. XXXVII A

1 to 3. Bangles; two incised oblique lines meeting at an acute angle; fragmentary. From Period II A. (Nos. 50, 183 and 20.)

4. Bangle; plain; fragmentary. From Period II A. (No. 27.)
5. Bangle; oblique lines carved; fragmentary. From Period II A. (No. 33.)
6. Bangle; fragmentary. From Period II A. (No. 33 A.)
7. Bangle; plain; fragmentary. From Period II A. (No. 222.)
8. Bangle; oblique lines engraved. From Period II A. (No. 384.)
9. Pendant. From Period II A. (No. 233.)
10. Circular inlay-piece. From Period II A. (No. 242 A.)
11. Circular inlay-piece. From Period II A. (No. 242.)
12. Rim of a vessel; grooved. From Period II A. (No. 235.) Occurs at Lothal and Mohenjo-daro also.

(vi) *Metal objects*

Copper and bronze objects.—Almost all the common metals except iron were known to the Rangpur folk in Periods II A, II B, II C and III. Although copper is said to have been worked at Rupavati in Damnagar Taluka of Amreli District in Kathiawar, the source was not exploited by the Harappans. It is more likely that Lothal imported copper ingots and worked them locally into tools. Celts, knives, bangles, razors, pins, daggers, rings, household vessels, fish-hooks, arrow-heads, spear-heads and seals made of copper and bronze have been found at Lothal. The Rangpur folk used celts, pins, bangles, rings, amulets, etc. Normally, low-tin bronze was in use but high-tin bronze was also known. The absence of arsenic in the bronze from Rangpur and its presence to the extent of two to seven per cent in Harappan bronze may suggest different sources or technique. Nickel and iron occur as minor impurities in the bronze tools from Rangpur. The technique of casting and forging as known to the Harappans at Rangpur in Period II A and followed by their successors in Period II C was very elementary when compared with the technique in west Asia. A high percentage of tin is found in the following objects, the highest being in a bangle from Period II C:—Period II A, (1) copper celt (no. 663), (2) hollow bangle (no. 169), (3) knife (no. 141) and (4) knife (no. 526); and Period II C, solid bangle (no. 437). Apparently most of the objects were made of copper with low tin, while some of the tools were of high-tin bronze.

The total number of copper objects found at Rangpur is twentyfive, out of which seven are fragments of indeterminate shape. The Period-wise distribution of the remaining eighteen objects is as follows:—Period II A, seven; Period II B, one; Period II C, nine; and Period III, one. It is, therefore, evident that copper and bronze objects were in considerable use in Periods II A and II C, while in Periods II B and III they were extremely scarce. The significance of this distribution is not without import. In the post-flood days (Period II B) there was a sudden decline in the material prosperity of the inhabitants and they could not import metal objects or metal. But in course of time when the refugees had settled down and attempts were made to revive earlier traditions, trade also must have been revived. During this time, evidences of contact with other parts of India are apparent from the occurrence of the Lustrous Red Ware elsewhere and from the introduction of a couple of new painted motifs in Period II C. Once again copper was also imported. In Period III, however, there must have been a general scarcity of metal at Rangpur as in all the other chalcolithic sites in India for reasons not known.

CELTS.—Two flat copper celts with a sharp round cutting-edge and almost a flat butt were found in the occupation-deposits of Periods II A and II B. They must have been hafted to split handles. The celt which has a crescentic cutting-edge (fig. 55, *1*) was recovered from Period II A level, while the one with straight sides came from Period II C (fig. 55, *2*). Two celts engraved with peacock-designs as the Mohenjo-daro ones are now in the Rajkot Museum. They are said to adduce further evidence of the extension of the Harappa culture into Gujarat.[1]

KNIVES.—Two fragmentary knives were recovered from the cuttings in the central parts of the mound and are assigned to Period II C (pl. XXXV A, *3* and *4*). Knives are rare at Harappa and Mohenjo-daro as well.

PINS AND NEEDLES.—Copper pins were in use in Periods II A, II B and III. The finest specimen comes from layer 18 of RGP 6. It has a rolled head and a sharp point obtained by an oblique cut (fig. 55, *7;* pl. XXXV A, *7*). Another pin is slightly curved at the top. These pins seem to have been used for sewing and knitting purposes. Lothal has yielded a needle with eye, besides those without it. Pins with rolled heads have not been noticed at Mohenjo-daro and Harappa; they occur in the Jhukar levels of Chanhu-daro.

Fig. 55; pl. XXXV A

1. Celt; flat with a lenticular cross-section; broken butt; slightly-concave sides and splayed-out working-edge. From Period II A. (No. 663.)
2. Celt; flat with lenticular cross-section and broken crescentic working-edge; much worn out. From Period II C. (No. 324.) Similar types have been found at Mohenjo-daro[2] and Harappa.
3. Knife; roughly rectangular in section. From Period II C. (No. 417.)
4. Knife; blade broken; sharp cutting-edge. From Period II C. (No. 526.)
5. Pin; circular section. From Period III. (No. 330.)
6. Needle; slightly-curved but sharp end; circular section. From Period II A. (No. 141.)
7. Pin; rolled head and obliquely-cut end; circular in section. From Period II B. (No. 442.)

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[1] M. G. Dikshit in *Vallabh Vidyanagar Research Bulletin*, I, pt. 1 (1957), pl. VIII B.
[2] Marshall, *op. cit.*, III, pl. CXXXIX, *6*.

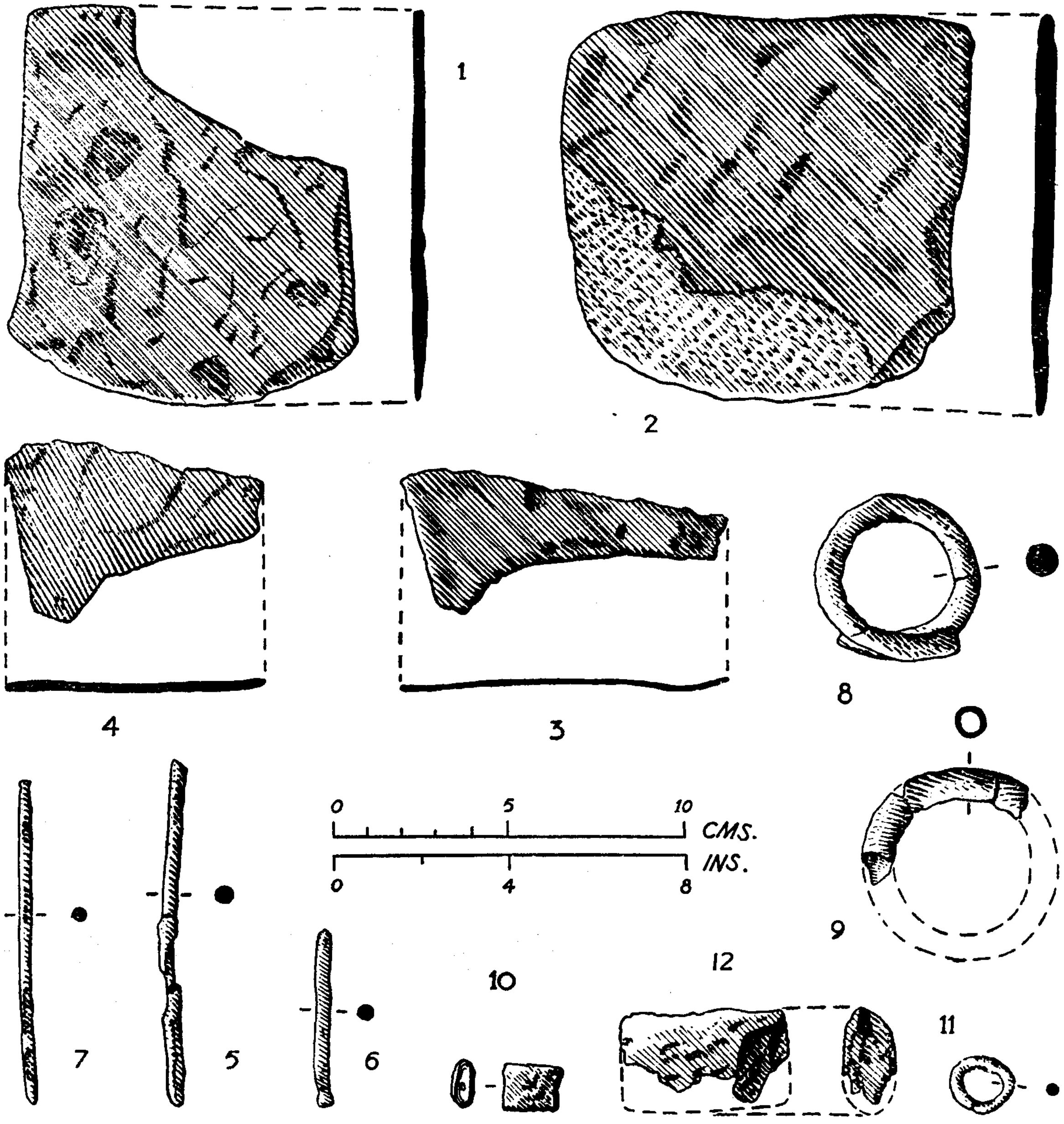

FIG. 55. *Copper and bronze objects*

COPPER ORNAMENTS.—Bangles, rings, amulets and beads of copper and bronze were used by the Harappans and their successors at Rangpur. Three bangles, two rings, a bead and an amulet were recovered in the course of the present excavation. Bangles are of two types, viz., hollow and solid, both of which occur at Harappa and Mohenjo-daro. The hollow bangles from Periods II A and II C of Rangpur are found to have been prepared by beating a copper plate to the required shape and the joint is clearly visible on the interior. Only one complete solid bangle was found in the early levels of Period II C. Two finger-rings and an amulet came from Period II A. Besides these, several copper pieces of indeterminate shape were also found in various levels.

Fig. 55; pl. XXXV B

8. Bangle; circular section; solid. From Period II C. (No. 437.)
9. Bangle; circular section; hollow; fragmentary. From Period II C. (No. 446.)
10. Bead; rectangular biconvex. From Period II A. (No. 260.)
11. Finger-ring; circular section. From Period II A. (No. 635.)
12. Amulet; ovoid section; hollow. Damaged. From Period II A. (No. 170.)

GOLD AND STEATITE ORNAMENTS (pl. XXXIV B).—Among ornaments gold beads have been referred to above (p. 147). A fragment of a necklace with four circlets which might have been used as a spacer bead came from Period II A levels (pl. XXXIV B, *2*). It is a good example of fine workmanship. Another interesting find is a steatite ornament of floral design dusted with gold (pl. XXXIV B, *1*) and also came from the last phase of the mature Harappa culture. The gold dust comes off with a touch from the ornament. A button-like faïence object was found in Period II A levels in RGP 3 (pl. XXXIV B, *3*).

N. SCIENTIFIC EXAMINATION OF METAL OBJECTS FROM RANGPUR

by *Dr. B. B. Lal*

There were thirteen objects in all for chemical analysis and examination. Nearly all these objects are heavily corroded and covered with greenish corrosion-products. For the analysis of the metallic cores, suitable portions of the objects were freed from incrustation and corrosion-products by filling and subsequent treatment with acid. Care was taken to exclude all foreign matter and to select as far as possible homogeneous parts of the objects for chemical analysis. Many of these objects have undergone extensive mineralization right down to the core and difficulty was experienced in preparing specimens having apparently a uniform composition. The results of chemical analysis are recorded in the table on p. 153.

A comparison of the data with the published analysis of Indus valley objects would show that copper and bronze were used for making domestic utensils, celts, knives, bangles, finger-rings and other artefacts. High-tin bronze was also in vogue, but the use of this alloy was rather restricted, probably on account of the scarcity of tin. The percentage of arsenic in these objects is appreciable; some objects contain as much as two to seven per cent, whereas the objects under investigation do not show presence of arsenic. Lead is generally absent; only three objects show its presence in traces.

The study of these objects shows that the techniques of casting and forging were well-understood by the craftsmen of the time. The use of tin as a deoxidizing agent and for hardening copper was also known.

From the analytical data tabulated below, it is observed that most of the objects are made of copper with nickel and iron as minor impurities and tin in small proportions. The proportion of tin is, however, fairly high in nos. 437, 169, 141, 526 and 663. The presence of tin to the extent of 11·07 per cent in no. 437 shows that it is composed of bronze. Low-tin bronze was used for making nos. 169, 141, 526 and 663, which show a tin percentage of 6·94, 6·78, 5·28, and 4·09 respectively. From these figures it is concluded that the use of tin was well-understood for making bronze. Zinc is generally absent and arsenic could be detected in two specimens only. Nickel, however, is present in these objects but only in small proportions. It is, therefore, likely that nickel was derived from the ore used in smelting copper and was not an intentional addition. Small quantities of iron are also present in almost all the specimens. Lead is present in traces only in three specimens.

SAMPLE NO.	NO.	DESCRIPTION	COPPER	TIN	ZINC	LEAD	IRON	NICKEL	ARSENIC	OXYGEN BY DIFF.	TOTAL
1	324	Copper celt	91·20	2·60	..	Tr.	..	2·10	..	4·10	100·00
2	663	Copper celt	91·35	4·09	..	Tr.	..	Tr.	Tr.	4·60	100·00
3	437	Copper bangle	86·40	11·07	..	Tr.	..	1·80	Tr.	0·73	100·00
4	417	Copper knife	94·80	0·70	..	..	Tr.	0·40	..	4·10	100·00
5	330	Copper pin	91·80	0·60	..	..	1·88	5·88	..	..	100·16
6	442	Copper pin	96·60	Tr.	..	..	1·86	0·80	..	0·74	100·00
7	260	Copper bead	96·66	Tr.	..	..	1·40	0·38	..	1·56	100·00
8	635	Copper ring	96·10	Tr.	..	..	0·45	0·20	..	3·25	100·00
9	169	Copper bangle	57·70	6·94	..	..	Tr.	Tr.	..	35·46	100·00
10	170	Copper amulet	77·60	Tr.	..	..	0·57	0·10	..	21·73	100·00
11	141	Copper pin	65·40	6·78	..	..	0·24	0·51	..	27·08	100·00
12	526	Copper knife	59·00	5·28	..	..	Tr.	Tr.	..	35·72	100·00
13	525	Copper knife	59·60	2·69	..	..	1·08	..	..	36·63	100·00

NOTE: Samples 1 to 4 were analysed by Shri B. R. N. Sharma and 5 to 13 by Shri R. P. Mehrotra, both Chemical Assistants.

O. ANIMAL-REMAINS FROM RANGPUR

by *Bhola Nath*

This report deals with the collection of animal-remains from Rangpur excavated during the field seasons of 1953-56. The remains from Rangpur are from seven different cuttings, viz., RGP 1 to RGP 7. All the bones from RGP 3, RGP 4 and RGP 7 belong to Period II A, representing the true Harappa culture. Remains from cuttings RGP 1, RGP 2, RGP 5 and RGP 6 belong to the post-Harappa periods, viz. Periods II B, II C and III. The fauna which lived in different Periods of the sites are given below.

The following species from RGP 3, RGP 4 and RGP 7 belong to Period II A: *Bos indicus*, *Bos* (*Bubalus*) *bubalis*, *Ovis vignei*, *Capra hircus aegagrus* and *Sus scrofa cristatus*.

The following species from RGP 1 belong to Period II C: *Bos indicus* and *Sus scrofa cristatus*.

The following species from RGP 1 belong to Period III: *Bos indicus, Bos (Bubalus) bubalis, Ovis vignei, Capra hircus aegagrus* and *Sus scrofa cristatus.*

The following species from RGP 2 belong to Period II C: *Bos indicus, Bos (Bubalus) bubalis, Ovis vignei* and *Capra hircus aegagrus.*

The following species from RGP 2 belong to Period III: *Bos indicus, Bos (Bubalus) bubalis, Ovis vignei, Capra hircus aegagrus* and *Canis familiaris.*

The following species from RGP 2 belong to Period III: *Bos indicus, Bos (Bubalus) bubalis, Ovis vignei, Capra hircus aegagrus, Canis familiaris* and *Xancus pyrum.*

The following species from RGP 5 belong to Period II B: *Bos indicus, Bos (Bubalus) bubalis, Ovis vignei* and *Sus scrofa cristatus.*

The following species from RGP 5 belong to Period II C: *Bos indicus, Bos (Bubalus) bubalis* and *Ovis vignei.*

The following species from RGP 5 belong to Period III: *Chitra indica, Equus asinus, Bos indicus, Bos (Bubalus) bubalis, Ovis vignei, Capra hircus aegagrus, Cervus unicolor* and *Sus scrofa cristatus.*

The following species from RGP 6 belong to Period II B: *Bos indicus, Bos (Bubalus) bubalis, Ovis vignei, Capra hircus aegagrus* and *Sus scrofa cristatus.*

The following species from RGP 6 belongs to Period II C: *Bos indicus.*

The following species from RGP 6 belong to Period III: *Bos indicus, Bos (Bubalus) bubalis, Ovis vignei* and *Sus scrofa cristatus.*

These animal-remains in general resemble in their species those of Harappa,[1] Mohenjo-daro,[2] Hastināpura,[3] Maski,[4] Rupar,[5] Anau,[6] Sialk[7] and Shah Tepe.[8]

In most cases the animal-remains from Rangpur are very fragile and fragmentary in nature. The organic material of bones has disappeared to a great extent and they are impregnated with inorganic material. The bones have thus become mostly mineralized. Even the long bones are either broken or are fragmentary in nature.

Most of the bones consist of fragments only and are, therefore, unsuitable for measurements etc. In many cases charred bones have been found as at Harappa and Mohenjo-daro. Nine fragments of bones in the present collection, seven of which belong to *Bos indicus*, one to *Bos (Bubalus) bubalis* and one to the *Sus scrofa cristatus*, have definite chopping-marks by sharp instruments on them, which probably indicates that the inhabitants used the animals for food.

As in the case of Anau, Mohenjo-daro, Harappa and Rupar, there are a large number of bones which belong to young animals, indicating thereby that the people practised a full-fledged domestication of these animals.

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[1] B. Prashad, *Animal Remains from Harappa*, Mem. Arch. Surv. Ind., no. 51 (Delhi, 1936).

[2] R. B. S. Sewell and B. S. Guha in Marshall, *op. cit.*, II, pp. 649-73.

[3] B. Nath, 'Animal-remains (from Hastināpura)', *Ancient India*, nos. 10 and 11 (1954 and 1955), pp. 107-20.

[4] B. Nath, 'Animal-remains (from Maski)', *ibid.*, no. 13 (1957), pp. 121-29.

[5] B. Nath, 'Animal-remains from Rupar' (unpublished).

[6] J. U. Duerst, 'Animal-remains from the excavations at Anau', *Explorations in Turkestan: Prehistoric Civilization of Anau* (Washington, 1908), II, pp. 341-442 and pls. 71-91.

[7] R. Ghirshmann, *Fouilles de Sialk pres de Kashan*, II (Paris, 1939), pp. 195-97.

[8] J. W. Amschler, 'Tierreste der Ausgrabungen von dem "Grossen Königschugel" Shah Tepe in Nord Iran', *Sino-Swedish Expedition*, Publication 9, VII, no. 4 (1939), pp. 35-124.

Altogether one thousand eight hundred and fortyseven fragments of animal-bones have been examined, out of which *Bos indicus* Linn. alone comprised 78 per cent, *Ovis vignei* and *Capra hircus aegagrus* together 11 per cent, *Sus scrofa cristatus* Wagner 8 per cent, *Bos* (*Bubalus*) *bubalis* Linn. 2 per cent, and the rest 1 per cent. Thus, it appears that the most favourite animal domesticated by the Rangpur people was the *Bos indicus* Linn.

I am grateful to my Director, Dr. M. L. Roomwal for the encouragement and interest shown in this work as well as for his suggestions.

DESCRIPTION OF REMAINS

A. Invertebrata: Phyllum Mollusca

Class: Gastropoda

Order: Pectinibranchia

Xancus pyrum Linn. (The Shank Shell)

1. Fragment of a shell sawn through. From Period III. (RGP 1-201.)
2. Inner core or columella without shell covering. From Period III. Pl. XXXVIII, *1*. (RGP-2, 502.)

These remains of the shank-shell, though fragmentary in nature, are quite distinctive and resemble those from Mohenjo-daro and in the collection of the Zoological Survey of India.

The sawing-through of one of the fragments referred to above shows that it was used in the manufacture of ornaments, such as bangles, rings and other fancy goods.

B. Vertebrata

Class: Reptilia

Order: Chelonia

Family: Trionychidae

Chitra indica Gray (The Chitra)

1. Fragment of the epiplastron. From Period III. Pl. XXXVIII, *2*. (RGP 5-1354a.)
2. Fragment of the epiplastron. From Period III. (RGP 5-1354b.)

The fragments of the epiplastron resemble in pattern and vermiculations those of Mohenjo-daro, Harappa, Hastināpura and Rupar.

Class: Mammalia

Order: Carnivora

Family: Canidae

Canis familiaris Linn. (The Domestic Dog)

Fragment of the right horizontal ramus of the mandible without teeth, body (*Corpus mandibulae*) and the vertical ascending ramus. From Period III. Pl. XXXVIII, *3* and *4*. (RGP 2-766.)

The above-mentioned solitary fragmentary find of a ramus of mandible of a dog is wholly devoid of teeth. It, however, resembles in size, shape and configuration those of Mohenjo-daro, Harappa and Rupar, as well as the modern specimen of a pariah dog in the Zoological Survey. Below is given a table of measurements of the height of horizontal ramus of mandible of all these specimens.

MEASUREMENTS (IN MM.) OF THE HEIGHT OF MANDIBLE OPPOSITE MOLAR 1, IN *CANIS FAMILIARIS* LINN.

RANGPUR	HARAPPA	MOHENJO-DARO	RUPAR	ZOOLOGICAL SURVEY
18	22	23	20	18

It is evident from the above table that the Rangpur specimen is extremely close to the modern pariah dog met with in India.

Order: Perrissodactyla

Family: Equidae

Equus asinus Linn. (The Domestic Ass)

1. Right upper second molar tooth. From Period III. Pl. XXXVIII, *5* and *5a.* (RGP 5-1245a.)
2. Right os magnum of the right distal tarsus. From Period III. Pl. XXXVIII, *6* and *6a.* (RGP 5-1245b.)

The remains of the domestic ass referred to above resemble closely the modern specimen of *Equus asinus* in the collection of the Zoological Survey of India. Of the teeth, only the upper second molar (pl. XXXVIII, *5* and *5a*) is available, which is quite intact and well-preserved. I give below a table of its measurements.

MEASUREMENTS (IN MM.) OF UPPER SECOND MOLAR OF *EQUUS ASINUS*

DESCRIPTION	RANGPUR	SUB-RECENT HARAPPA	954 B/N HARAPPA	ZOOLOGICAL SURVEY
Length of crown	20	16	21	18
Width of crown	19	20	21	20
Length of protocone	8	7	7	10
Length from posterior margin of crown to antecrochet	11	9	12	10
Length from posterior margin of crown to anterior lobe of protocone	14	13	16	13

The only other available find of *Equus asinus* is that of the right os magnum of the distal tarsal (pl. XXXVIII, *6* and *6a*). Its maximum antero-posterior surface length is 35 mm. and medio-lateral breadth 39 mm.

The remains of the domestic ass have also been recorded from Harappa, Rupar and Maski.

Order: Artiodactyla

Family: Bovidae

Bos indicus Linn. (The Zebu or Domestic Humped Cattle of India)

Altogether, one thousand three hundred and thirtyseven fragments of bones of the humped cattle have been recorded, out of which fiftyfour fragments of bones belong to Period II A and the rest to the later Periods. Most of the bones including the long bones are very fragmentary in nature and are of no use for exact measurements. The very frequency with which the remains of the *Bos indicus* Linn. have been met with in the excavation as compared with the finds of other animals indicates that the inhabitants probably used to maintain large herds of this animal. In a number of cases the remains are of young ones and are charred. Seven fragments of bones have definite cut-marks on them.

Some of the well-preserved specimens, such as the fragment of the lower jaw (pl. XXXVIII, *7*), the fragment of a horn-core (pl. XXXVIII, *8*) and some well-preserved and intact specimens of the lunate bone (pl. XXXVIII, *9*) and cuneiform bone (pl. XXXVIII, *10*) of the proximal carpus and those of the astragalus (pl. XXXIX, *2*) and the patella bone (pl. XXXIX, *1*), are illustrated.

The remains of the humped cattle from Rangpur resemble the smaller humped short-horned variety from Harappa, Mohenjo-daro, Hastināpura, Maski and Rupar.

From the very close resemblance between the skeletal remains excavated at Rangpur and those of the modern domestic humped cattle of India in the collection of the Zoological Survey of India, it is clear that the Rangpur remains are of the same species as those of the domesticated cattle even now met with in India.

Bos (*Bubalus*) *bubalis* Linn. (The Indian Domestic Buffalo)

Only fortyfour fragments of bones of the domestic buffalo have been recorded, out of which six belong to Period II A and the rest to Periods II B to III. The occurrence of a smaller number of fragments indicates that the inhabitants did not maintain large herds of this animal as compared with *Bos indicus*.

Some of the well-preserved specimens, such as the fragment of a horn-core (pl. XXXIX, *3* and *3a*) along with a portion of frontal bone of skull, the proximal fragment of radius (pl. XXXIX, *4*) and the complete specimen of astragalus (pl. XXXIX, *5*), are illustrated.

The remains of the buffalo show very close structural resemblance with those of the modern domestic buffalo in India. They are also similar to those of Harappa, Mohenjo-daro, Hastināpura and Maski.

Capra hircus aegagrus Erxleben (The Domestic Goat)

Sixtysix fragments of the domestic goat have been recorded from Rangpur, and out of these six belong to Period II A. They are very fragmentary.

The available teeth do not show any specialized peculiarities and generally resemble those of the recent domestic goat. Fragment of a lower jaw is illustrated here, (pl. XL, *1*.)

Some of the well-preserved specimens, such as the fragment of a horn-core (pl. XL, *2*) and the distal fragment of the left humerus (pl. XL, *3*), are illustrated.

Fragments of bones from Rangpur closely resemble those of the remains from Harappa, Hastināpura and Maski.

Ovis vignei Blyth, race *domesticus* (The Domestic Sheep)

The Rangpur collection includes nintyfour fragments of bones of the domestic sheep, and out of these nine belong to Period II A. All the remains are very fragmentary.

The available teeth do not show any peculiarities and generally resemble those of the recent domestic sheep. The photograph of a fragment of the lower jaw is reproduced on pl. XL, *4*.

Some of the better-preserved and intact specimens, such as the fragment of a horn-core (pl. XL, *5*), an atlas vertebra (pl. XL, *6*) and calcaneum (pl. XL, *7*), are reproduced here.

Fragments of bones from Rangpur closely resemble those of the remains of the sheep from Harappa, Hastināpura, Maski and Rupar.

Family: Cervidae

Cervus unicolor Kerr. (The Sambar Deer)

Only a single fragment of an antler with a portion of beam and brow-tine (pl. XL, *8*) along with the burr of an adult specimen have been obtained from Rangpur. This antler has been sawn off through the pedicle, just below the base of the burr and removed from the animal after it had been killed.

Sewell and Guha recorded this species from Mohenjo-daro, while Nath has recorded it from Rupar.

Family: Suidae

Sus Scrofa cristatus Wagner (The Indian Domestic Pig)

Altogether one hundred and fourteen fragments of bones of this animal from Rangpur have been recorded and out of these only four belong to Period II A.

Some of the.better-preserved bones, such as the astragalus (pl. XL, *9*), calcaneum (pl. XL, *10*), the fourth metatarsal bone (pl. XL, *11*), the conspicuous bones such as the fragment of mandible (pl. XLI, *1*), the right upper canine or tusk (pl. XLI, *2*), and the long bones, viz. the humerus (pl. XLI, *3*) and radius (pl. XLI, *4*), are reproduced here.

A few vertebrae present in the collection are rather small in size and lack the vertebral epiphysis, indicating thereby that they belong to young individuals. Some well-preserved vertebrae, such as the atlas vertebra (pl. XLI, *5*), fragment of axis vertebra (pl. XLI, *6*), fragment of a cervical vertebra (pl. XLI, *7*) and a lumber vertebra (pl. XLI, *8*), are illustrated here.

Most of the teeth are poorly preserved. A well-preserved specimen of the third molar tooth of an upper jaw (pl. XLI, *9*) from Rangpur is illustrated here along with those of Mohenjo-daro (pl. XLI, *10*), Harappa (pl. XLI, *11*) and Hastināpura (pl. XLI, *12*) for comparison. The third molar tooth of the lower jaw (pl. XLI, *13*) is also re-included. Amongst the remains two bones are charred and one bears definite cut-mark on it.

To sum up the following species frøm RGP 3, RGP 4, RGP 7 belong to Period II A: *Bos indicus* Linn.; *Bos* (*bubalus*) *bubalis* Linn.; *Ovis vignei* Blyth, race *domesticus; Capra hircus aegagrus* Erxleben; and *Sus scrofa cristatus.*

The animal-remains of Periods II B to III from RGP 1, RGP 2, RGP 5 and RGP 6 include the following species: *Xancus pyrum* Linn.; *Chitra indica* Gray; *Canis familiaries* Linn.; *Equus asinus* Linn.; *Bos indicus* Linn.; *Bos* (*bubalus*) *bubalis* Linn.; *Ovis vignei, race domesticus*; *Capra hircus aegagrus* Erxleben; *Cervus unicolor* Kerr; and *Sus scrofa cristatus.* There are nine fragments of bones in this collection which have definite chopping-marks on them made by sharp instruments; out of them seven belong to *Bos indicus*, one to *Bos* (*Bubalis*) *bubalis* Linn., and one to *Sus scrofa cristatus.* This indicates that the inhabitants probably used these animals for food.

EXPLANATION OF PLATES

Pl. XXXVIII

Xancus pyrum Linn.

1. Inner core or columella without shell covering. From Period III. (RGP 2-502.) Scale: $\frac{4}{5}$.

Chitra indica Gray

2. Fragment of epiplastron. From Period III. (RGP 5-1354a.) Scale: $\frac{2}{3}$.

Canis familiaris Linn.

3. Fragment of the right horizontal ramus of the mandible without body (corpus mandibulae), and the vertical ascending ramus. From Period III. (RGP 2-766.) Scale: $\frac{4}{5}$.

4. Right ramus of the mandible of a modern pariah dog in the Zoological Survey. Scale: $\frac{4}{5}$.

Equus asinus Linn.

5. Lingual view of right upper second molar. From Period III. (RGP. 5-1245a.) Scale: $\frac{1}{1}$.

5a. Buccal view of the same. Scale: $\frac{1}{1}$.

6. Dorsal view of the right of magnum of distal carpal. From Period III. (RGP 5-124b.) Scale: $\frac{1}{1}$.

6a. Volar view of the same.

Bos indicus Linn.

7. Fragment of left horizontal of mandible with first, second and third molar teeth. From Period II C. (RGP 3-801a.) Scale: $\frac{1}{2}$.

8. Right horn-core. From Period II B. (RGP 2-1071.) Scale: $\frac{3}{5}$.

9. Lunate bone of proximal carpus of right manus. From Period III. (RGP 2-720.) Scale: $\frac{1}{1}$.

10. Right cuneiform bone of proximal carpus of right manus. From Period III. (RGP 1-291.) Scale: $\frac{1}{1}$.

Pl. XXXIX

Bos indicus Linn.

1. Right patella bone. From Period III. (RGP 5-1407.) Scale: $\frac{4}{5}$.

2. Left astragalus. From Period III. (RGP 6-1754a). Scale: $\frac{1}{1}$.

Bos (Bubalus) bubalis Linn.

3. Dorsal view of the fragment of left horn-core with a portion of frontal bone. From Period II B. (RGP 3-1072.) Scale: $\frac{1}{4}$.

3a. Ventral view of the same.

4. Proximal fragment of left radius with a portion of ulna. From Period II B. (RGP 2-1074.) Scale: $\frac{3}{5}$.

5. Left astragalus. From Period II B. (RGP 2-1073.) Scale: $\frac{3}{5}$.

Pl. XL

Capra hircus aegagrus Erxleben

1. Fragment of the right horizontal ramus of the mandible with first, second and third molar. From Period II B. (RGP 2-978.) Scale: $\frac{3}{4}$.
2. Fragment of a horn-core. From Period II A. (RGP 7-168.) Scale: $\frac{4}{5}$.
3. Distal fragment of the left humerus. From Period III. (RGP 5-1180.) Scale: $\frac{4}{5}$.

Ovis Vignei Blyth, *race domesticus*

4. Fragment of the right horizontal mandible. From Period III. (RGP 5-1191.) Scale: $\frac{4}{5}$.
5. Fragment of horn-core. From Period II C. (RGP 2-801.) Scale: $\frac{4}{5}$.
6. An atlas vertebra. From Period II B. (RGP 5-1636.) Scale: $\frac{4}{5}$.
7. Right calcaneum. From Period III. (RGP 2-539.) Scale: $\frac{1}{1}$.
8. A fragment of an antler. From Period III. (RGP 5-1373.) Scale: $\frac{3}{5}$.

Sus scrofa cristatus Wagner

9. Left astragalus fused with a fragmentary piece of calcaneum. From Period III. (RGP 2-538.) Scale: $\frac{1}{1}$.
10. Left calcaneum of a young one. From Period III. (RGP 6-1746.) Scale: $\frac{3}{5}$.
11. Right fourth metatarsal. From Period III. (RGP 2-689a.) Scale: $\frac{1}{1}$.

Pl. XLI

Sus scrofa cristatus Wagner

1. Body (mandibular Symphysis) of the mandible with two incisor teeth. From Period III. (RGP 2-535.) Scale: $\frac{1}{1}$.
2. Right upper canine or tusk (charred). From Period III. (RGP 1-312.) Scale: $\frac{11}{10}$.
3. Distal fragment of left humerus. From Period III. (RGP 5-1169.) Scale: $\frac{3}{4}$.
4. Distal fragment of right radius of a young one. From Period III. (RGP 5-1397.) Scale: $\frac{2}{3}$.
5. Almost complete atlas vertebra. From Period III. (RGP 2-618.) Scale: $\frac{1}{1}$.
6. Fragment of axis vertebra with a portion of body, odontoid process and anterior articular process. From Period III. (RGP 5-1190.) Scale: $\frac{1}{1}$.
7. Cervical vertebra without spinous and transverse processes. From Period III. (RGP 6-1816.) Scale: $\frac{9}{10}$.
8. A lumber vertebra with spinous and right transverse process. From Period III. (RGP 1-329.) Scale: $\frac{4}{5}$.
9. Fragment of right upper jaw with third molar tooth. From Period III. (RGP 5-1393.) Scale: $\frac{9}{10}$.
10. Left upper third molar, worn out. (SD-1586.) Mohenjo-daro. Scale: $\frac{1}{1}$.
11. Left upper third molar. (DS-27.) Harappa. Scale: $\frac{1}{1}$.
12. Left upper third molar. From an early level of Period III. (HST 1-1391.) Hastināpura. Scale: $\frac{1}{1}$.
13. Left lower third molar tooth. From Period III. (RGP 1-356.) Scale: $\frac{1}{1}$.

P. Plant-remains from Rangpur

by *S. S. Ghosh* and *Krishna Lal*

(i) *Introduction*

Altogether, thirtytwo samples out of thirtysix received from different cultural Periods were examined under the microscope. It has been possible to determine the identity of practically all the plant-remains sent to us. Due to the highly-deteriorated nature of the specimens, we have, however, been cautious in confining our determinations mainly up to the generic level of the plants. The analysis of the results shows that the charcoal-samples represent five different groups of timber. The major group is represented by more than one species of *Acacia*. This is followed by *Albizzia*, *Soymida febrifuga*, *Pterocarpus santalinus* and *Tamarix* sp. Besides these, some fragmentary plant-remains were also detected, such as rice-husk, one type of charred grain (*bajra*), epidermis of monocot and deteriorated wood. It may be noted that all the charcoal-samples identified are from timbers of economic importance.

(ii) *Material*

In all thirtysix samples in an equal number of packets were sent to us for examination. Out of these, four samples from packets nos. 5, 28, 31 and 35 were discarded after a preliminary checking as they were considered to be of no value from botanical point of view. The remaining samples fall under the following Periods: 1-4, 6-17, 19-27, 29, 30, 32 and 33, Periods II B, II C and III; and 18, 34 and 36, Period II A, as illustrated in table I.

Table I

Sl. no.	Period
1-4	1500 B.C. to 800 B.C.
6-17 and 19-25	-do-
26-27, 29-30 and 32-33	-do-
18, 34 and 36	2000 B.C. to 1500 B.C.

(iii) *Method of study*

The charcoal-samples varied in size from very small to fairly-big lumps but the majority of the pieces were small. In shape also they varied from irregular lumps to somewhat uniformly- and clearly-cut material split either transversely or longitudinally or in both planes in some cases. The condition of these materials was far from satisfactory, the majority being soft and fragile and often turning powdery in processing. The technique of preparing sections was, therefore, elaborate and very slow but the general procedure followed was the one developed previously in this laboratory.[1] In short, depending upon

[1] S. S. Ghosh and K. A. Chowdhury in *Ancient India*, no. 13 (1957), p. 133; K. A. Chowdhury and S. S. Ghosh, 'The study of archaeological plant-remains and its significance', *Trans. Bose Res. Inst.*, Calcutta (1955), p. 81.

the nature of the plant-remains, embedding in only paraffin or in clove-oil celloidin followed by paraffin was done. The fragmentary wood-remains could be sectioned only after embedding in celloidin.[1] The epidermal structures were cleaned in dilute hydrochloric acid and mounted after dehydration. All the photomicrographs were taken by transmitted light with the help of the Universal Camera Microscope.

(iv) *Results of study and identification*

As the number of samples examined is large, it has been thought advisable not to describe each and every specimen according to locus and stratum, so as to avoid unnecessary repetition. It is, therefore, proposed to describe specimens according to their botanical affinities after making an analysis of all the material studied. However, for the sake of enumeration, information has been given in table II, (below, p. 170) indicating the identity of all the plant-materials according to trenches and Periods.

A scrutiny of table II will reveal that the charcoal-samples belong to five distinc groups of timber. These will be described here first. In addition to this, other miscellaneous fragmentary plant-remains will be dealt with separately under Group 6 below.

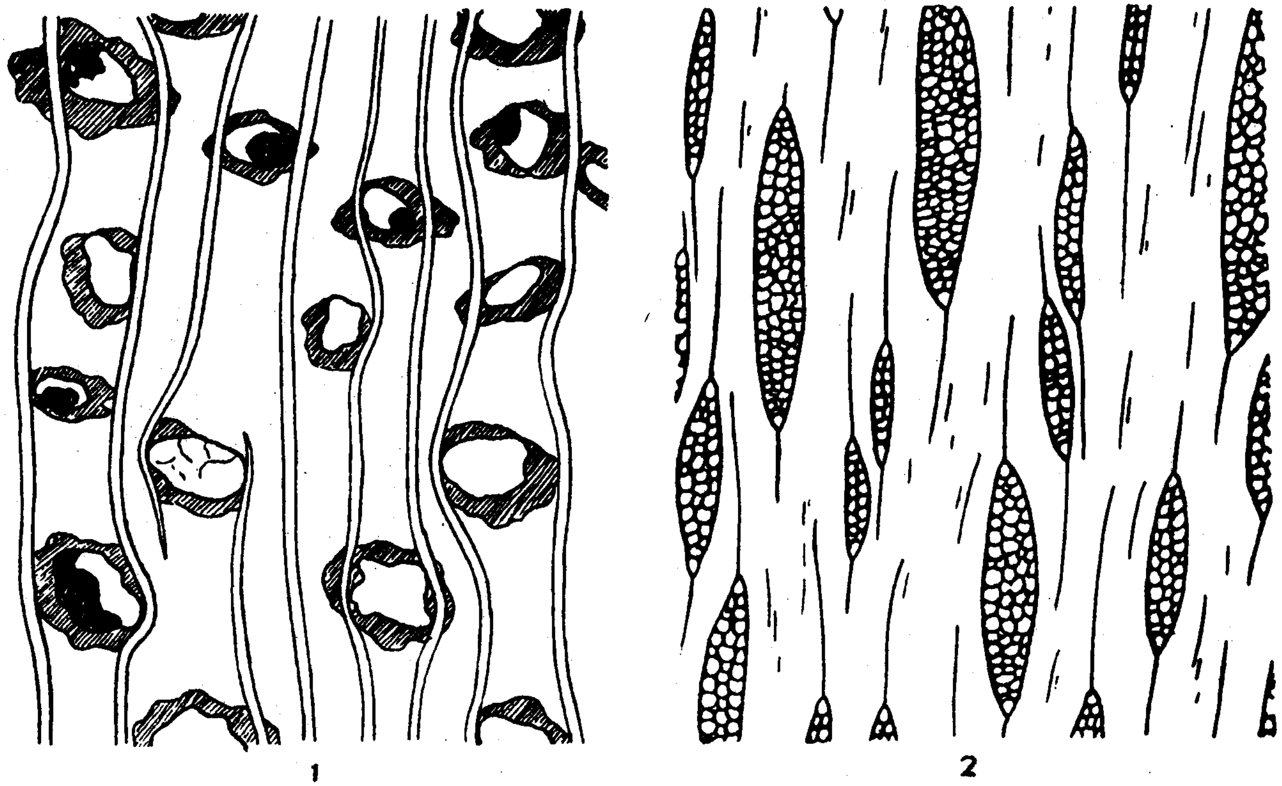


FIG. 56. *RGP 2: XVII-XXII, XIX-XX, 16: 1 (×55), cross-section showing arrangement of parenchyma round the vessels; 2(×135), tangential section showing broad rays of homocellular type*

[1] J. E. Lodewich, 'A shorter celloidin method', *Science*, 60 (1924).

GROUP 1: *ACACIA* SP.

(Figs. 56 to 59; pls. XLII, *1* to *7* and XLIV, *1*)

Material.—RGP 2: XVIII-XXII, XIX-XX, 16[1]; XVIII-XXII, XX-XXI, 29; XVIII-XXII, 30, 34. RGP 5: 0-II, 9; II-IV, 9; 0-II, 10; II-IV, 10; 0-II, 13; 0-II, 14; II-IV, 15; 0-II, 17; and II-IV, 17. RGP 6: IV-VI, pit 2 sealed by 4; and VI-VIII, 18.

Gross Feature.—The charcoal-pieces are of various sizes, ranging from 0·5 cm. ×0·5 cm. to 1·8 cm. × 1·0 cm. Most of the material is small, rather irregular in shape, sometimes with vertical fissures from where splitting often occurred when pressed. Some samples also show horizontal cracks which are responsible for the crumbling of the specimens into smaller pieces. A few samples appear fairly dense and heavy while others are not so. The grain is usually interlocked or somewhat twisted except in a few cases which appear rather straight-grained. In texture, they are even and medium-coarse. The gross structure reveals that all are *diffuse-porous woods.*

Microscopic structure—*Growth rings* have not been observed in any sample. *Vessels* are small to medium-sized, the latter just visible to the eye, and the former visible only under the lens; few to moderately few (4-6 per sq. mm.), sometimes also moderately numerous (8-12 per sq. mm.); mostly solitary, less often in radial multiples of 1-2 or more; roundish to oval in shape; vessels vary from 42μ -252μ in diameter; gummy deposits often partially fill up the pore cavity. *Parenchyma* cells are vasicentric, forming thin to thick sheath round the vessels; sometimes conspicuous, aliform to aliform confluent connecting neighbouring vessels sideways. *Fibres* are not preserved well, often losing shape while cutting sections; usually roundish in cross-section, fairly thick-walled and

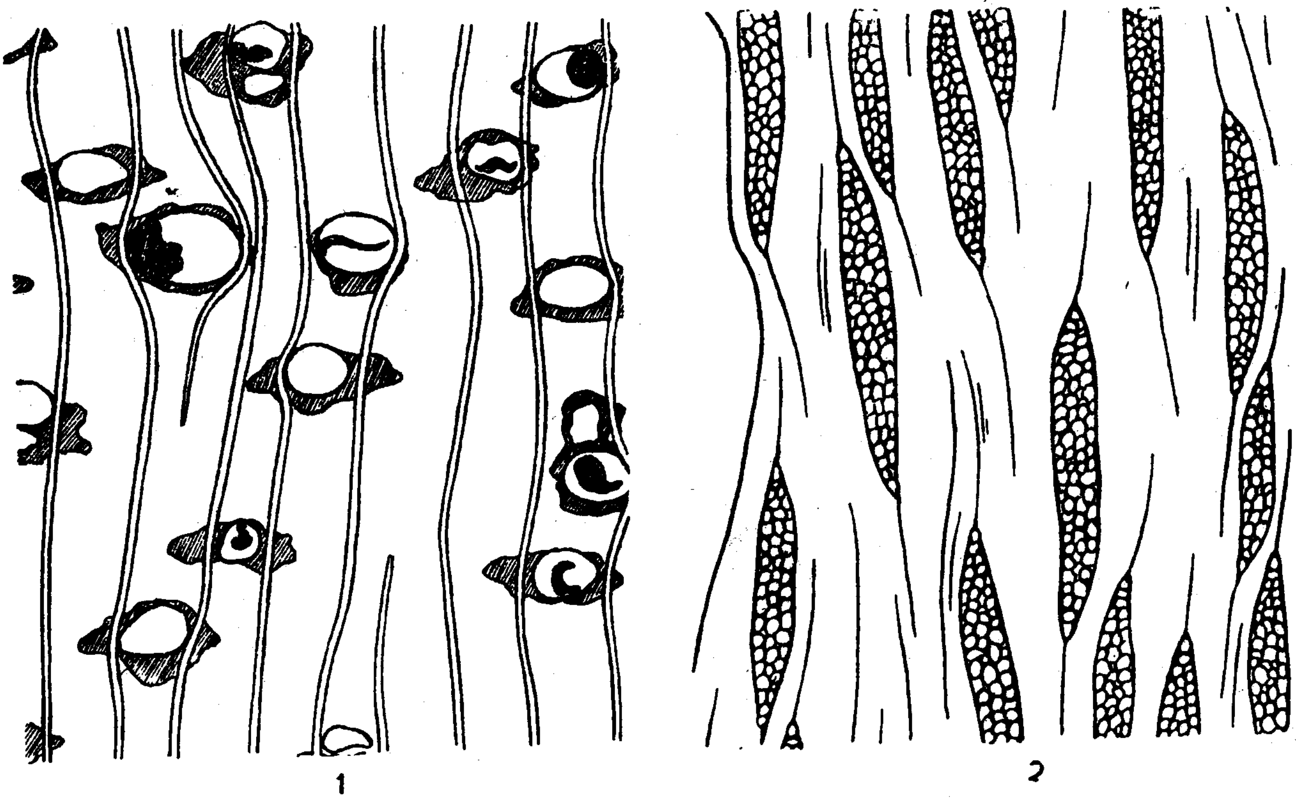


Fig. 57. *RGP 2: XVIII-XXII, XX-XXI, 29: 1 (×55), cross-section showing vessel parenchyma distribution; 2 (×135), tangential view of ray characteristics*

[1] The Roman numerals denote the locus and the Arabic ones layers.

arranged rather irregularly. *Rays* are usually broad, 1-6 seriate, up to 70μ in width but in some cases only 1-3 or 4 seriate and up to 56μ in width; maximum height of the rays is 36 cells and 420μ, they are nearly homocellular.

GROUP 2: *ALBIZZIA* SP,

(Fig. 60; pls. XLII, *8-9* and XLIII, *3-7*)

MATERIAL.—RGP 5: IV-VI, 4; 0-II, 9; IV-VI, 10; 0-II, 12; II-IV, 12; and 0-II, 13. RGP 6: IV-VI, 2.

GROSS FEATURE.—The charcoal-pieces are usually small, being less than 0·6 cm. × 0 6 cm. in size. A few samples of the sizes 1·2 cm. × 1·0 cm., 1·8 cm. × 1·0 cm. and 1·0 cm. × 1·9 cm. present in some cases have been of help for preparing microscopic sections. They are mostly irregular in shape but some are fairly rectangular. It is difficult to judge the grain, but indications are that some may be straight and a few somewhat interlocked-grained. All samples appear even and somewhat fine-textured. All are *diffuse-porous woods.*

MICROSCOPIC STRUCTURE.—*Growth rings* are not visible due to limited field. *Vessels* are not clear to the eye but distinct under the lens, medium-sized to small, evenly distributed, moderately few (5-8 per sq. mm.), mostly solitary, occasionally in radial multiples of 2 or 3, roundish to oval in shape; vessels vary in diameter from sample to sample, being about 70μ-182μ in some, and 98μ-168μ or 56μ-224μ in others; black deposits sometimes fill up the pore cavity. *Parenchyma* vasicentric to aliform appearing as a distinct 'halo' round the vessels; seldom extending sideways to join nearby vessels. *Rays* visible only under lens but distinct under the microscope, 1-4 seriate (mostly 2-3) and 35μ-42μ in width; maximum ray height is 26 cells and 448μ; homocellular. *Fibres* are mostly deformed due to deterioration but appear non-libriform in better-preserved sections.

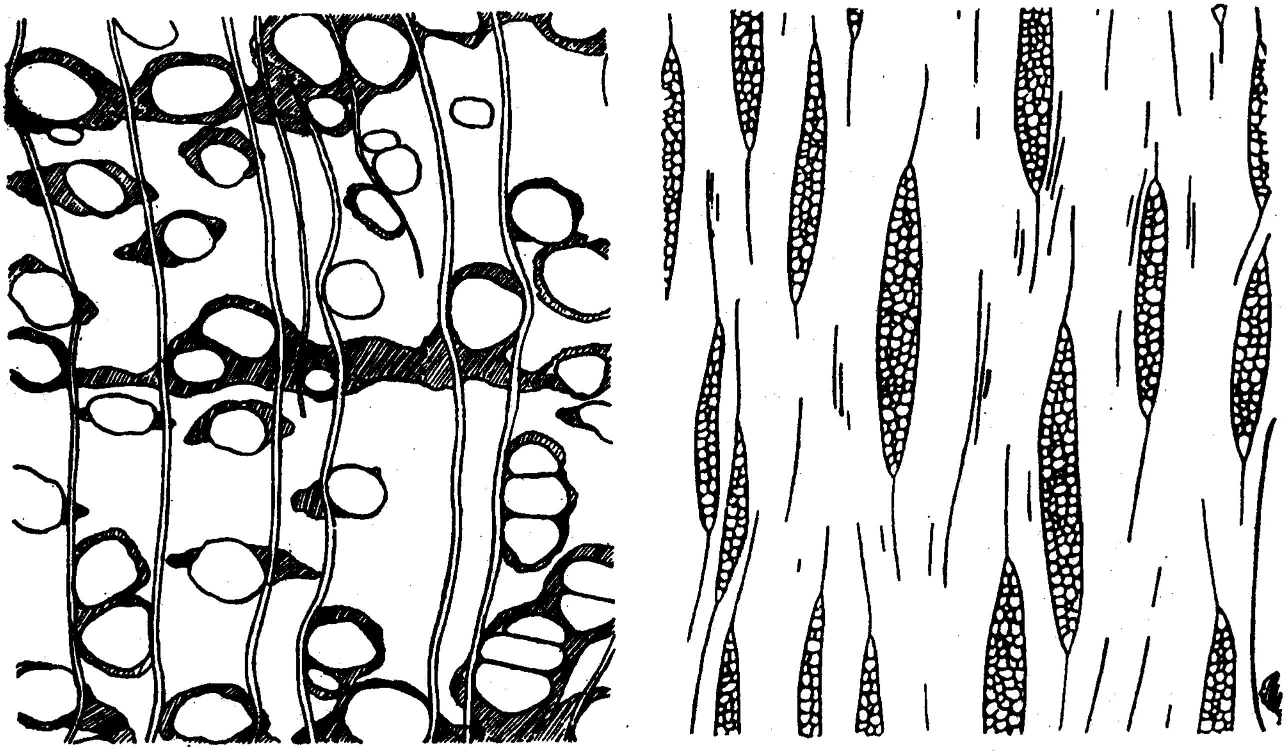


FIG. 58. *RGP 5: II-IV, 10:1* (×*55*), *cross-section to show linking of vessels by parenchyma; 2* (×*135*), *tangential view of the ray*

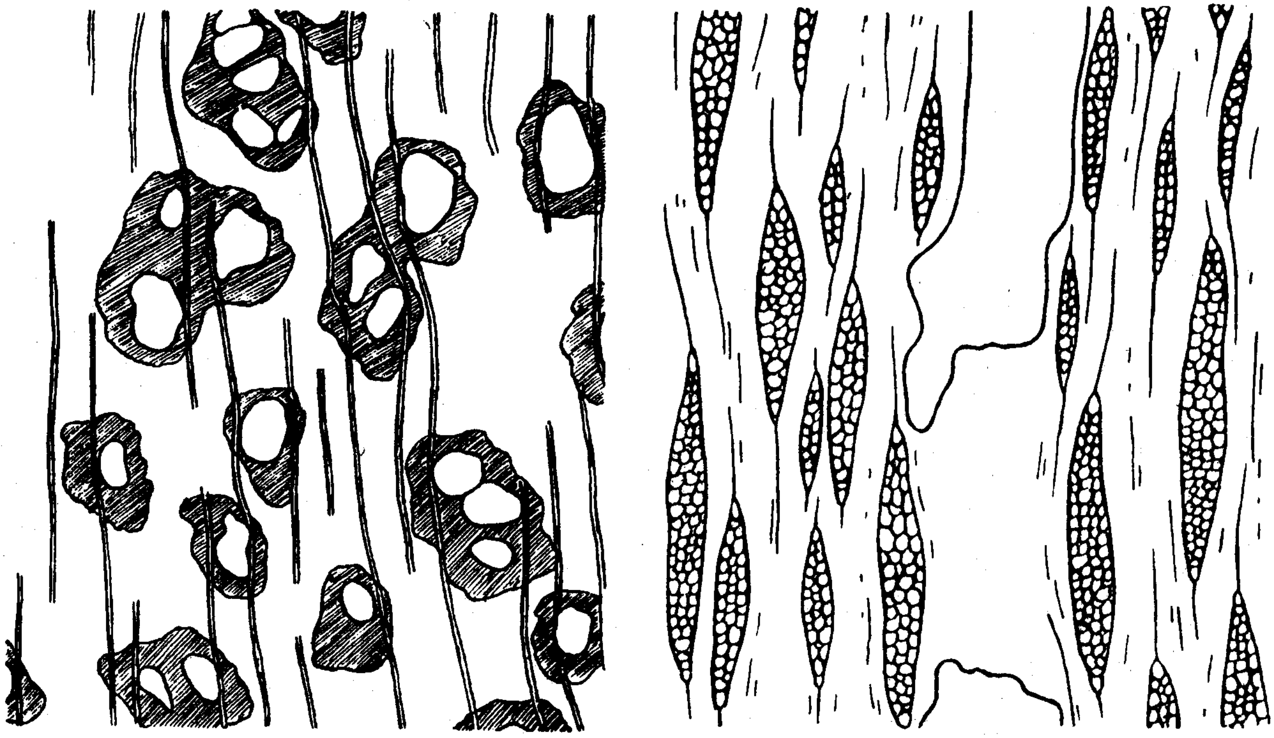
GROUP 3: *SOYMIDA FEBRIFUGA*

(Fig. 61; pl. XLIV, *2* and *3*)

MATERIAL.—RGP 5: II-IV, 9; 0-II, 10; and II-IV, 10.

GROSS FEATURE.—The samples are small to very small and extremely fragile. The largest sample worth examining measured 0·8 cm. ×0·9 cm. These are mostly cracked and irregularly shaped on all the surfaces and appear to be somewhat twisted-grained and coarse-textured. All are *diffuse-porous woods.*

MICROSCOPIC STRUCTURE.—*Growth rings* are not visible due to the presence of many cracks on the end-surfaces. *Vessels* are just visible to the eye, moderately small to medium-sized, moderately numerous (11-13 per sq. mm.), solitary or in radial multiples of 2-3; vessels vary from 70μ to 168μ in diameter and are usually plugged with black gum-like deposits. *Parenchyma* cells are rather abundant but not very clear due to bad preservation. They generally appear as a sheath round the vessels and sometimes also extend sideways to connect neighbouring pores. *Rays* are fairly broad, 1-5 seriate and 42μ-56μ in width; maximum ray height 42 cells and 560μ; individual cells are fairly large, round to oval in shape and somewhat heterocellular in composition.



1 2

FIG. 59. *RGP 5: 0-II, 17:1 (×55), cross-section showing characteristic vasicentric parenchyma in relation to vessels; 2 (×135), ray distribution and composition in tangential view*

GROUP 4: *PTEROCARPUS SANTALINUS*

(Fig. 62; pl. XLIII, *1* and *2*)

MATERIAL.—RGP 6: II-IV, 3.

GROSS FEATURE.—The two charcoal-pieces found in the packet are very irregular in shape and show both horizontal and vertical cracks. They are fairly heavy, interlocked-grained and rather fine-textured. They are a *diffuse-porous wood.*

MICROSCOPIC STRUCTURE.—*Growth rings* are indistinct. *Vessels* are not visible to the naked eye but fairly distinct under hand-lens; very small to medium-sized, moderately few (5-7 per sq. mm.), evenly distributed, often oval in shape, solitary and in radial multiples of 2-4; vessels vary in diameter from 70μ-168μ; tyloses absent but black gum-like deposits are present in some pores. *Parenchyma* is characteristic and is mainly arranged in thin, wavy tangential bands, occasionally joining one or more vessels across the rays; also vasicentric as a thin sheath round the pores; diffuse parenchyma is not clear. *Rays* are very fine, visible only under the lens, 1-2 seriate (mostly 1) and 21μ wide, maximum height up to 12 cells and 210μ; homocellular. *Ripple marks* are distinct.

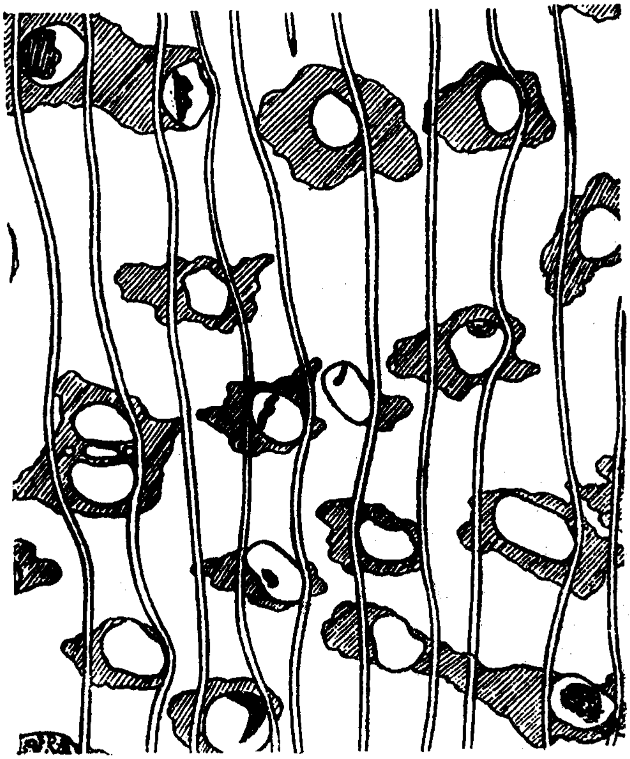
GROUP 5: *TAMARIX* SP.

(Fig. 63; pl. XLV, *1*)

MATERIAL.—RGP 6: VI-VII, 18.

GROSS FEATURE.—The charcoal-pieces are very few, usually being 0·8 cm. ×0·9 cm. and 1 cm. ×1 cm. in size; irregular in shape and very fragile. It is a *diffuse-porous wood.*

MISCROSCOPIC STRUCTURE.—*Growth rings* not observed due to limited field of observation. *Vessels* are distinct under the lens, small to moderate-sized, usually in clusters, seldom solitary or in radial or oblique pairs, moderately few, often aligned in tangential rows; vessels are mostly open and vary from 21μ-84μ in diameter. *Parenchyma* cells are not very clear and are usually limited to a thin layer round the vessel or vessel groups. *Fibres* are non-libriform and are rather irregularly arranged. In between the vessel rows, they form wide and compact tracts. *Rays* are very broad and widely spaced, visible to the naked eye on the end-surface, at least 3-8 seriate (due to extreme deterioration correct estimation not possible) and about 98μ in width and 420μ in height; individual ray cells are large and ray type nearly homocellular. *Ripple marks* are not clear.



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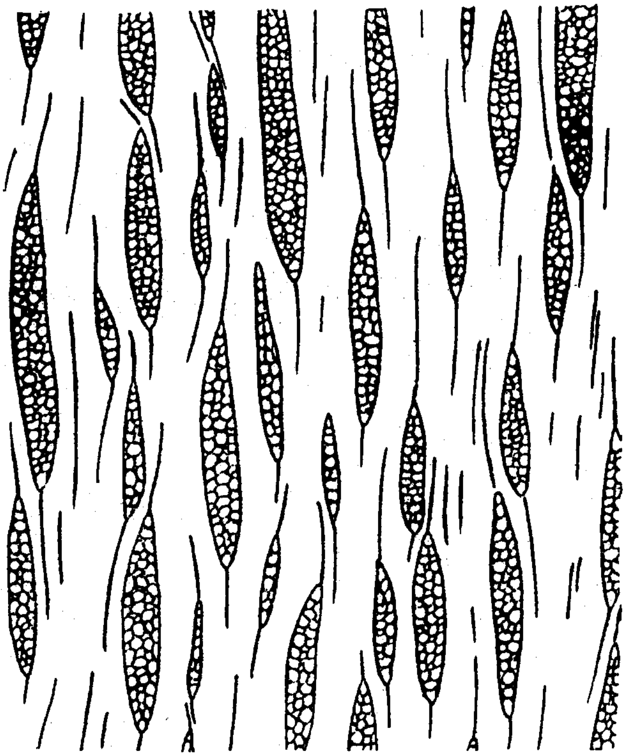


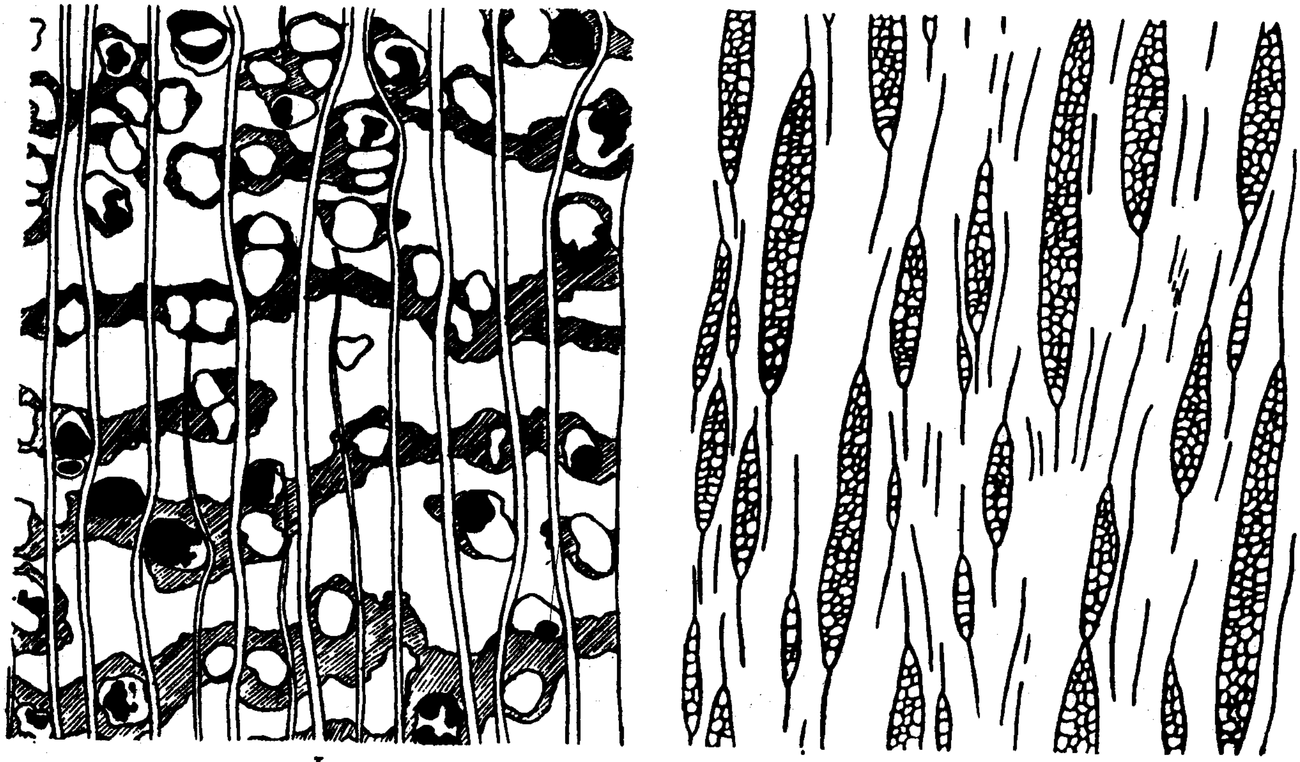
2

FIG. 60, *RGP 6: IV-VI, 2:1* (×*55*), *cross-section showing aliform to vasicentric parenchyma; 2* (×*135*), *rays narrow to wide and homocellular*

GROUP 6: MISCELLANEOUS PLANT-REMAINS

A. Epidermis of a monocot (pl. XLIV, *4* and *5*)

Material.—RGP 5: 0-II, 9. The packet consists of a number of charcoal-pieces of different sizes. Among these, two pieces which are comparatively large show a fairly thick layer of greyish-coloured mud adhering to the flat surfaces. A careful examination under the hand-lens indicated impressions of some scrappy plant-material. The charcoal-pieces were, therefore, transferred to watch-glasses and the mud dissolved out. A little acid was used to remove the mud-particles and clear the plant-structure. As this did not take any stain, whole mounts were made for microscopical examination.



1 2

Fig. 61. *RGP 5: II-IV, 10: 1 (×55), cross-section showing vessel distribution and arrangement; parenchyma conspicuous and extend sideways joining vessels; 2 (×135), rays 1-5 seriate and heterocellular*

Anatomical feature.—The general arrangement of the epidermal cells is in distinct parallel rows indicating monocotyledoneus structure. Two types of material are recognizable:

(i) In this type epidermis is silico-suberous type, long cells alternating with short cells forming parallel rows. The short cells are usually in pairs, one member being a silica cell and the other a cork cell. The long epidermal cells have thin and corrugated walls and range from 17μ to 71μ in length, the average width of the cell being 10μ. The silica cells are somewhat rectangular in shape and are 10-12μ in width and 3-7μ in height. The cork cells are usually comparatively smaller in sixe than the silica cells and are compressed. They are more or less rectangular in shape, the long sides being at right angles to the axis of the organ, and are 10-11μ in width and 1·5-3μ in height. Stomata are 27μ × 17μ in size and scattered in arrangement. Taking all these features into consideration, this material appears to be stem epidermis of some grass.

(ii) In this type, epidermis is very characteristic showing peculiar-shaped silica cells. The long epidermal cells are rectangular, usually being broadest near about the middle of the cell and

gradually tapering at both ends. They have thin and straight walls, occasionally with undulating margins, and range from 23·66μ to 94·64μ in length with an average width of 14·23μ. The silica cells are characteristic with varied shapes such as dumb-bell, halter and many others. The two bulbs in the dumb-bell type are usually connected by a narrow short, neck. Sometimes silica cells with three or more bulbs are also met with. In size the silica cells are 12μ-34μ in length. The maximum width is about 10μ at the broadest and a little or 43μ at the thinnest point. Cork cells are not recognizable in the field of observation. The material is, therefore, not enough for determination and it is not possible to say anything about the part of the plant to which it belongs.

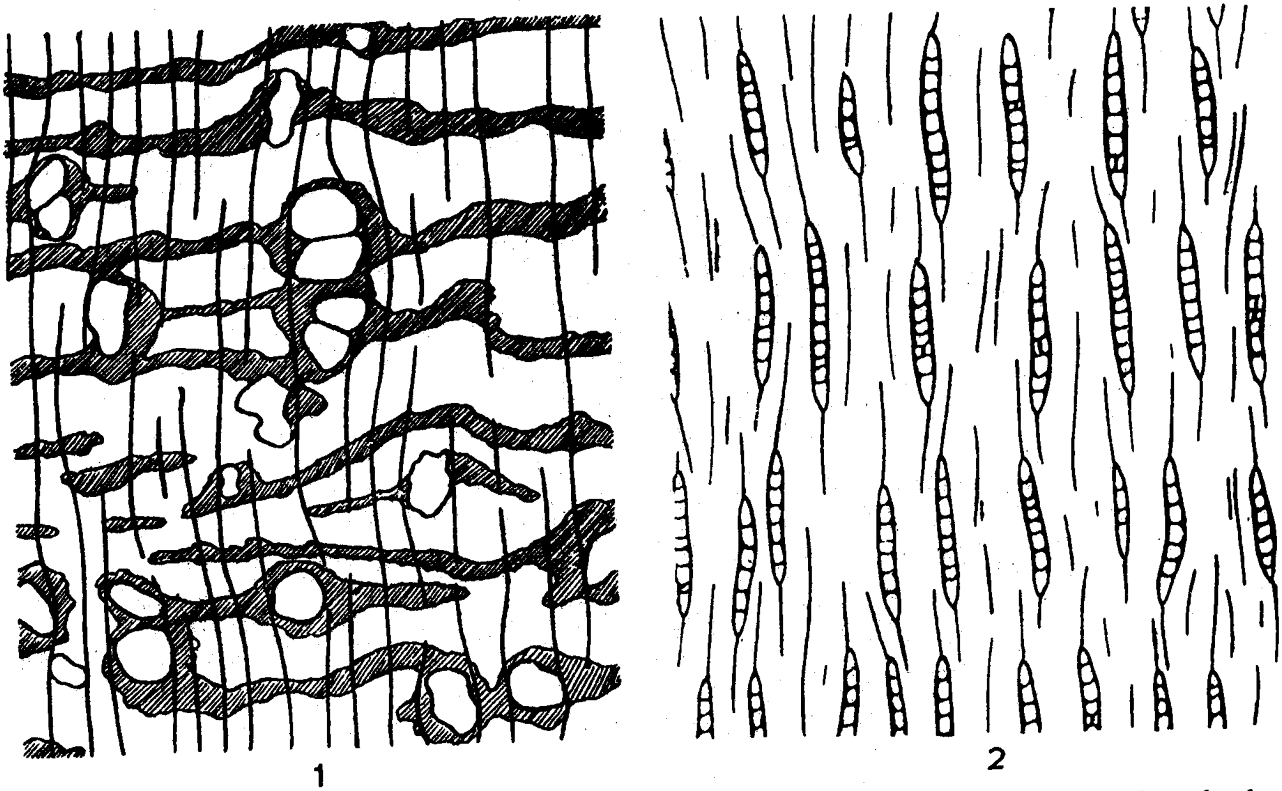


FIG. 62. *RGP 6: II-IV, 3:1 (×55), Cross-section showing characteristic arrangement of parenchyma bands; 2 (×135), tangential view of fine rays and ripple marks*

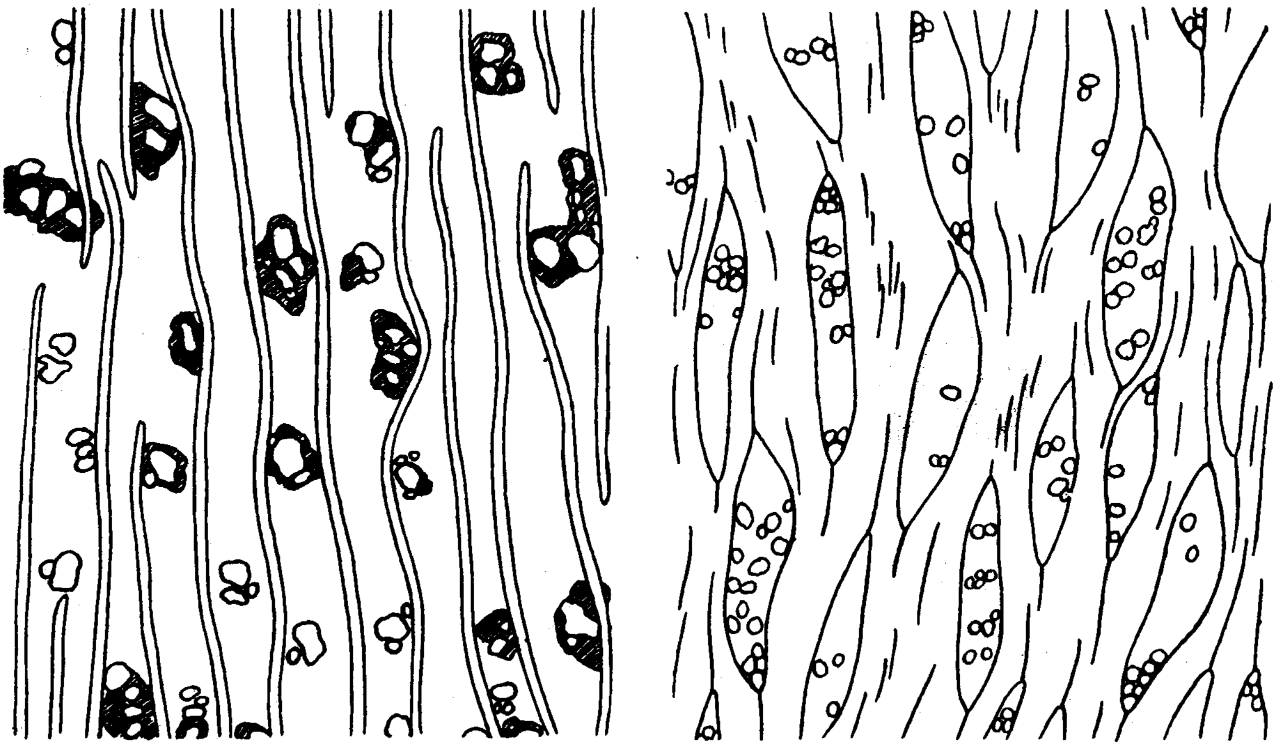
B. RICE-HUSK (pl. XLIII, *8*)

MATERIAL.—RGP 7: 0-III, 13. This packet contains several lumps of burnt or half-burnt mud. Some of the specimens are, however, flat and measure about 1·50 cm. ×2·0 cm. Here some impressions of plant-like materials are noticeable when examined carefully with a lens. The lumps were, therefore, soaked in water in watch-glasses. A few drops of hydrochloric acid were then added to help in the distintegration of the lumps. After careful washings and removal of the mud-particles, the plant tissues embedded in the mud separated out. These were then picked up with the help of a brush and transferred to another watch-glass.

ANATOMICAL STRUCTURE.—Under the hand-lens, characteristic chess-board pattern of the rice-husk becomes clear at once. When examined under the microscope, ridges and grooves are also apparent as well as thick zigzag epidermal cells in parallel rows. This characteristic pattern in surface-view immediately confirms the structure of husk of rice (*Oryza* sp.)

C. Charred grain (pl. XLIV, *6-9*)

Material.—RGP 6: 0-II, 2. This consists of a hard black mass with groups of somewhat roundish carbonized grains embedded in shiny tar-like substance. Due to carbonization, the spikelets so firmly stuck together that it is not possible to dissect out entire spikelets successfully. Glumes invariably crumbled but this somewhat helped in extracting the grains from the charred lump. When the grains are taken out, they leave behind socket-like structures in the lump.



1 2

Fig. 63. *RGP 6: VI-VIII, 18: 1 (×55) cross-section to show small vessels often in cluster; 2 (×135), very broad rays in tangential section: due to cell deterioration, ray composition incomplete*

Grain characteristics.—Grains are more or less obovate in shape, being roundish towards the apex and slightly pointed at the base. In size, they are 3-4 mm. long and 2·5-3·0 mm. broad. In certain grains at the basal portion on the ventral side, theem bryonic chamber is discernible with part of the membrane and the underlying embryo. It appears that due to charred condition these minute structures have become more apparent. The scar is also noticeable as a small roundish depression on the dorsal side at the basal region.

The available general morphologial features of the charred grains indicate similarity with two types of cereals, viz., *Pennisetum typhoides* Stapf. and Hubb. (*bājrā*) and *Sorghum vulgare* Pers. (*Andropogon sorghum* (L.) Brot.), commonly known as *jawār*. A careful checking particularly after charring some samples of live material, it was noticed to resemble *bajrā* or *pearl millet* (*Pennisetum typhoides*[1]) more closely.

D. Fragments of wood (pl. XLV, *2-8*)

Material.—RGP 7: A-C, 5. The packet contains a few fragmentary plant-remains which are somewhat golden-yellow in colour. They are very light and extremely delicate in nature.

[1] J. M. Hector, *Introduction to the Botany of Field Crops*, I—Cereals, (Johannesburg, 1936), p. 313.

As it was not possible to handle them, a few samples were selected for embedding after a preliminary gross examination. The size varied from 0·5 mm. to 2 mm. in length, but in most cases the width was less than 1 mm. As such, the field of observation was very limited. To get an idea about the structure, a few fragments were placed side by side for embedding and sectioning. By this method, a number of sections of different fragments were obtained at the same time. These sections have facilitated microscopic examination of this delicate material.

ANATOMICAL STRUCTURE.—*Growth rings* are not recognizable in the limited field, except for just a suggestion at places. *Vessels* are large and the size appears to diminish gradually. The occurrence of large vessels is somewhat closer tangentially as could be judged from their incomplete outlines. Unfortunately, the material was very scrappy to visualize whether this arrangement of large and smaller vessels could indicate ring-porous character of the wood. Vessels are oval to roundish, about 168μ-406μ in diameter; intervessel pits small. Tracheid-like vessels are distinct in tangential sections with suggestions of spiral thickenings in some. *Parenchyma* cells are not clearly visible except round the vicinity of some vessels. *Rays* are fairly broad, 1-4 seriate, 14μ-70μ in width and 84μ-882μ in height; ray type homocellular to somewhat heterocellular. *Fibres* are fairly thin-walled and non-septate.

It is difficult to identify this material with certainty. Taking into consideration the anatomical structure enumerated above, it has been seen that it shows similarity to *Melia* sp. in several respects. More than this it is not possible to say.

TABLE II

DETERMINATION OF PLANT-REMAINS

SL. NO.	TRENCH	PERIOD	CONTENTS	IDENTIFICATION	REMARKS
1	RGP 2	II B	Charcoal	*Acacia* spp.	
2	RGP 2	II B	Charcoal	*Acacia* spp.	
3	RGP 2	II B	Charcoal	*Acacia* spp.	
4	RGP 2	II B	Charcoal	*Acacia* spp.	
5	RGP 5	III	Charcoal	*Albizzia* spp.	
6	RGP 5	III	Charcoal	(a) *Acacia* spp. (b) Epidermis of monocot stem and other parts	Found embedded in mud sticking to the charcoal pieces
7	RGP 5	III	Charcoal	*Acacia* spp.	
8	RGP 5	III	Charcoal	*Albizzia* spp.	
9	RGP 5	III	Charcoal	*Soymida febrifuga*	
10	RGP 5	III	Charcoal	*Soymida febrifuga*	
11	RGP 5	III	Charcoal	*Acacia* spp.	
12	RGP 5	III	Charcoal	*Acacia* spp.	
13	RGP 5	III	Charcoal	*Soymida febrifuga*	
14	RGP 5	III	Charcoal	*Albizzia* spp.	
15	RGP 5	II C	Charcoal	*Albizzia* spp.	
16	RGP 5	II C	Charcoal	*Albizzia* spp.	
17	RGP 5	II C	Charcoal	*Albizzia* spp.	
18	RGP 7	II A	Burnt mud	Rice-husk	Embedded in the mud-plaster

TABLE II (*contd.*)

SL. No.	TRENCH	PERIOD	CONTENTS	IDENTIFICATION	REMARKS
19	RGP 5	II C	Charcoal	*Acacia* spp.	
20	RGP 5	II C	Charcoal	*Acacia* spp.	
21	RGP 5	II C	Charcoal	*Acacia* spp.	Very small piece
22	RGP 5	II B	Charcoal	*Acacia* spp.	Very small piece
23	RGP 5	II B	Charcoal	*Acacia* spp.	
24	RGP 5	II B	Charcoal	*Acacia* spp.	Very small piece
25	RGP 6	III	Charred grains	*Pennisetum typhoides*	Grains lumped in the tar-like matrix
26	RGP 6	III	Charred bits	*Pterocarpus santalinus*	Very small piece
27	RGP 6	III	Charcoal	*Acacia* spp.	Very small piece
28	RGP 6	III	Charcoal	*Albizzia* spp.	From ashy pit
29	RGP 6	II B	Charcoal	*Acacia* spp.	From ashy patch
30	RGP 6	II B	Charcoal	*Tamarix* spp.	Small pieces
31	RGP 7	II A	Pressured plant part	Melia spp.	Fragments of wood
32	RGP 7	II A	Charcoal	*Acacia* spp.	

(v) *Discussion*

A fairly large number of plant-materials have been excavated from Rangpur. For the sake of convenience of discussion, it is desirable to group them in the following table according to various occupational Periods:

TABLE III
OCCURRENCE OF PLANTS IN DIFFERENT PERIODS

PERIOD	NAME OF PLANT	REMARKS
II A	(1) *Acacia* spp. (2) *Melia* spp. (3) *Oryza* spp.	One sample One sample Husks of rice only
II B	(1) *Acacia* spp. (2) *Tamarix* spp.	Eight samples One sample
II C	(1) *Acacia* spp. (2) *Albizzia* spp.	Three samples Three samples
III	(1) *Acacia* spp. (2) *Albizzia* spp. (3) Monocot (4) *Soymida febrifuga* (5) *Pennisetum typhoides* (6) *Pterocarpus santalinus*	Five samples Four samples Epidermis fragments and stem epidermis Two samples Charred lump One sample

The collection of plants listed above is of considerable interest from several points of view. This gives not only an insight into the occurrence of types of trees but incidentally also throws some light on the climate and rainfall of the region in the past. Further, uses of these plant-materials add to our knowledge of certain cultural aspects of the people. These will be discussed here briefly.

CHARCOAL.—It is remarkable that the largest number of samples examined not only indicate occurrence of *Acacia* sp. but also its presence practically in all the occupational areas. A scrutiny of table III will reveal at once that about half of the material consists of *Acacia* only. A further examination of all these indicates the presence of more than one species of *Acacia*. In other words, this may mean that *Acacias* were not only common but also predominant trees. Incidentally it may be mentioned that even at the present time as many as nine different species of *Acacia* are found growing in Saurashtra.[1]

From the point of view of numbers, the next in importance is *Albizzia* sp. This has been found in larger numbers in Period III than II C but is absent in Periods II A and II B. Two distinct species, viz., *A. lebbeck* Linn. Benth. and *A. odoratissima* Linn. f. Benth. are still found in Saurashtra. Several samples of *Soymida febrifuga* Juss. have been noted in Period III but not elsewhere. This also occurs in Saurashtra at present, though it is not a very common tree. In Period III, *Petrocarpus santalinus* (*lal-chandan* or red sanders) is an interesting find, but this does not grow in Saurashtra at present. This has a limited distribution now in south India.[2] However, another species, *P. marsupium*[3] grows in Saurashtra but the timbers of these two are very different. In Period II B, the occurrence of *Tamarix* sp. is noteworthy, as it thrives well in saline situations. Recently, Santapau has recorded three species from this region. The occurrence of wood-fragments of *Melia* sp. from Period II A is also of interest. The only allied tree that grows now in Saurashtra is *Melia azedarach* (Persian lilac), but it is doubtful whether this is indigenous to India. The other species which is known as Malabar *neem*, *Melia composita*[4] is a large deciduous tree of south India growing up to Konkan, but the specimen under investigation does not appear to be this species. As the material is very fragmentary, we do not wish to go further, as that would involve speculation.

CEREALS.—It is surprising that as compared with the large number of charcoal-material, evidence of cereals is so meagre. Two types have only been recorded, (1) *Oryza* sp. (rice) from Period II A, and (2) *Pennisetum typhoides* (pearl millet or *bājrā*) from Period III. In the case of rice, husks (lemma and palea) are the only remains that give clue to this cereal. From the nature of their use, it appears that husks were mixed with the mud as a binding-material for the purpose of plastering. This practice has been noticed also in the Hastināpura excavation.[5] Though no grain or spikelet of rice has been observed, the manner of utilization of this by-product (husk) indicates the prevalence of rice in the region.

As regards *Pennisetum*, spikelets are fully carbonized and have got firmly embedded in the tar-like matrix. However, a careful dissection has revealed distinct charred grains. This indicates the use of this millet also in the past as at present in Saurashtra.

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[1] H. Santapau, *Plants of Saurashtra* (Rajkot 1953); H. Santapau and M. B. Raizada, 'Contribution to the flora of the Gir forests in Saurashtra', *Indian For.*, 80 (1954), p. 374.

[2] D. Brandis, *Indian Trees* (London, 1921).

[3] Santapau, *op. cit.* (1953).

[4] R. S. Pearson and H. P. Brown, *Commercial Timbers of India*, I (Calcutta,1932).

[5] K. A. Chowdhury and S. S. Ghosh, 'Plant-remains from Hastinapura', *Ancient India*, nos. 10 and 11 (1954 and 1955), p. 121.

Epidermis of monocots.—As this has been found mixed with the mud adhering to the charcoal, it is not unlikely that the straw of some cereals had also been used as a binding-material.

Uses of timbers.—The excavation has revealed altogether six different types of wood, the majority being *Acacias*. As these have come mostly in the form of charcoal, it is difficult now to visualize the exact purpose of their uses. It may, however, be noted that all of them, except probably *Tamarix*, are very important from the point of view of timber-utilization. *Acacias*[1] form important raw material for various constructional purposes as well as agricultural implements, some of the main uses being for house-posts, carts, ploughs, yokes, axles, spokes, felloes of wheels, carriages, oil- and cane-crushers, rice-pounders and well-curbs. This is also an excellent firewood. *Albizzias*[2] are also useful constructional woods and are good for house-posts, beams, agricultural implements, cart-wheels, ploughs, rice-pounders, high-class furniture and fuel. *Soymida febrifuga*[3] is a very hard, heavy and durable timber used for several specific purposes, such as house-posts, beams, cattle-troughs, plough-shares, oil-mills, wooden bearings, carving and turnery and ornamental articles. *Pterocarpus santalinus*[4] is a orange-red, purple or purplish-black wood popular in south India and used for ornamental house-posts and carving and turnery, including carved idols and figures in temples. It is also widely used in religious functions along with sandal-wood (*Santalum album*) for making a paste by rubbing on stones. This paste is usually applied to the forehead by priests and those performing religious rites. *Tamarix* sp.[5] is mainly used as cheap fuel, though locally it has other uses like rafters in house-building, well-construction, basket-making, hutments in villages, toys, etc. *Melia azedarach*[6] is particularly useful in villages for small roofing-material, ploughs, yokes, carts, agricultural implements, toys and small boxes.

Vegetation, climate and rainfall.—The collection of plant-materials from Rangpur is fairly rich. It will, therefore, not be unreasonable to visualize that the area was fairly well-wooded with medium-sized to large trees, shrubs and grasses. *Acacias* of more than one species were perhaps the most common trees all through the periods, and as such it would not be unnatural to expect its use for a variety of purposes. Similarly, *Albizzia* and *Soymida febrifuga* also contributed to the vegetation of the place indicating dry deciduous type with predominantly thorny trees like *Acacia*. In this connexion, the occurrence of *Melia azedarach* and *Tamarix* is also not without significance. In short, it may be mentioned that there has not been any major change in respect of important trees, as all the plants recorded from Rangpur are also met with even at the present time. According to the present classification of forest-types,[7] the area is grouped under dry tropical forests or tropical thorn-forests having deciduous and low thorny trees. The presence of *Acacias* indicates drier zones where they may occur gregariously in patches, small groups or scattered forests. Similarly, the nature of the Rangpur vegetation would appear to be of same dry deciduous type merging into thorn forests with certain typical species of saline areas like *Tamarix*. The present study of plant-materials, therefore, indicates that the climate and rainfall

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[1] Pearson and Brown, *op. cit.*, p. 437.

[2] *Ibid.*, p. 452; H. Trotter, *The Common Commercial Timbers of India and their Uses* (Dehra Dun, 1944).

[3] Pearson and Brown, *op. cit.*, p. 261.

[4] *Ibid.*, p. 395.

[5] K. A. Chowdhury and S. S. Ghosh, *Indian Woods, their Identification, Properties and Uses*, I, (Dehra Dun, 1958), p. 64.

[6] Pearson and Brown, *op. cit.*, p. 237.

[7] H. G. Champion, 'A preliminary survey of forest types of India and Burma', *Indian For. Rec.*, N.S., I, no. 1 (1936).

and have remained almost the same has not altered to any great extent from the point of view of forest types during the last three to four thousand years, as the present natural vegetation also comprises largely of similar species of *Acacia* and *Albizzia*, excepting for exotics which have been introduced later on like *Prosopis* and others. In this connexion the occurrence of agricultural crop like *Pennisetum* is also significant. However, the condition at present may be little more arid due to biotic factors as well as denudation and erosion.

EXPLANATION OF PLATES

Pl. XLII

Acacia sp.

1. Cross-section, showing scanty vessels and broad rays (×45).
2. Tangential section, showing multiseriate rays (×45).
3. Cross-section, showing parenchyma round the vessels (×45).
4. Another cross-section, showing vessel distribution (×45).
5. Tangential section, showing ray characteristics (×45).
6. Cross-section, showing size and arrangement of vessels (×45).
7. Another cross-section, showing large vessels, vasicentric parenchyma joining nearby vessels (×45).

Albizzia sp.

8. Tangential section, showing size and distribution of rays (×45).
9. Cross-section, showing vessel arrangement (×45).

Pl. XLIII

Pterocarpus santalinus

1. Cross-section, showing thin tangential bands of parenchyma in relation to vessel arrangement (× 45).
2. Tangential section, showing fine, uniseriate rays arranged in echelon (indicating ripple-marks) (× 45).

Albizzia sp.

3. Cross-section, showing vessel and parenchyma arrangement (× 45).
4. Another cross-section, showing dark deposits in vessels and rays (× 45).
5. Tangential section, showing homocellular rays (× 45).
6. Another cross-section, showing distinct vasicentric to aliform parenchyma (× 45).
7. Tangential section, showing ray distribution (× 45).

Oryza sp.

8. Outer surface of the husk with chess-board pattern (× 47).

Pl. XLIV

Acacia sp.

1. Cross-section, showing parenchyma round the vessels and connecting them sideways; rays are distinct and broad (× 45).

Soymida febrifuga

2. Cross-section, showing dark contents in vessels and rays (× 45).
3. Tangential section, showing deep, multiseriate rays (× 45).

Monocot epidermis

4. Epidermis, in surface view. Note corrugated long epidermal cells and oval-shaped silica cells (× 250).
5. Portion of above, highly magnified, showing several characteristic silica and cork cells and one stomata on the extreme right (× 1000).

Pennisetum typhoides

6. Lump of charred grains (actual size).
7. Grain, ventral side. Note more or less obovate shape and slightly pointed at the base (× 5).
8. Same, showing dorsal side (X 5).
9. Same, magnified to show distinct embryonic chamber at the basal portion (× 8).

Pl. XLV

Tamarix sp.

1. Cross-section, showing vessels mostly in clusters and widely spaced (× 45).

Melia sp.

2. Fragments of wood (actual size).

3-4. Cross-section, showing part of vessels, parenchyma and rays (× 63).

5. Radial section, showing tracheid-like vessels with spiral thickening (× 63).

6. Tangential section, showing ray characteristics (× 63).

7-8. Cross-sections of two more fragments, showing structural peculiarities (× 63).

3. EXPLORATION IN GUJARAT

A. Physical aspects of the region

Kathiawar, also known as Saurashtra, is almost a square peninsula projecting into the Arabian Sea (fig. 2, p. 9). It was once an island or a group of islands of volcanic origin. A belt of salt-land with occasional marshes and pools intervenes between the main-land and the peninsula, indicating thereby that the northern margin of Kathiawar from the Little Rann of Kutch to the Gulf of Cambay was once washed by the sea. It is surmised that the silt brought in by the Sabarmati, Luni, Rupen and Banas rivers filled up the shallow sea and joined the north-eastern part with the main-land. Excepting for this narrow alluvial belt Kathiawar is an undulating plain with several hills and a high plateau in the centre.

Speaking of the present-day conditions, it can be said that, lying between the desert of Sind and the wet lands of central and south Gujarat, Kathiawar represents the nature

of both. It can be divided physically into three regions, viz., the coastal lands, the inland plain and the hills. On the south the coastline is muddy and fringed in some areas with a line of wind-blown sand-hills, as can be seen at Mitli near Cambay and Gogha near Bhaunagar. In the north-west it is a line of low roofs fringed with mangroves as at Porbandar. Behind the coastline, however, there is a fertile region drained by several rivers radiating from the central highlands. It is this fertile strip which was occupied in protohistoric and early historical times. The colonizers settled down on the coastline in the first instance and, when pressed by fresh waves of immigrants, moved into the interior towards the central hills. The access to the peninsula from the mainland lies at present mainly through the Wadhwan (Surendranagar) Gateway on the north-east, a triangular region underlain by the Umia series. In prehistoric times this region must have been a swamp or *rann*. The process of connecting the island with the mainland is still not complete as suggested by the presence of the Little Rann, on the north, the Nal lake in the centre and the salt waste in between. The Bhal-Nal region further south is an alluvial plain drained by sluggish streams running parallel to one another. Being a low-lying area, it is subject to extensive floods and the coastal fringes are marshy.

The hills in the central part of the peninsula can be divided into the north-eastern and the south-western series. The north-eastern series are generally sterile except on the extreme west near the Barda hills and throw off several branches in different directions. They are indented by numerous streams into ridges. Several Late Harappan sites are located on the banks of some of the streams, e.g., Gop, Rojdi, Pitaria, Randalio, Adkot, etc. In early historical times Junagadh near Girnar hills was the provincial capital of the Mauryas, the Kshatrapas and Gupta rulers. The main consideration was the natural defence. Subsequently Valabhī became the capital of the Maitrakas and Ghumli of the Jethvas.

The central highlands form the water-parting between the rivers which flow in different directions. They are very swift at their headwaters but wind their way sluggishly as they pass through lowlying lands to the sea. The drainage-system is radial.

The physical features of Kutch are almost similar to those of Kathiawar. Kutch was also an island once upon a time, the shallow sea between the peninsula and the mainland being slowly filled up by the silt brought in by the rivers Banas and Luni. The Bhuj series in the centre of the peninsula consists of the Deccan trap overlain by laterites in some places and miliolites in others. Wind-blown sand caps the rock in certain areas. The central bowl near Bhuj is fairly fertile. The narrow coastal strip silted up by the swift-flowing rivers from the central hills is also fertile on the south and north-west. The north-east is either a salt waste or is marshy. A branch of the Indus river known as Nara used to join the Rann of Kutch but as a sequel to the upheaval during the earthquake of 1833 it ceased to flow into the Rann.

The mainland of Gujarat is essentially an alluvial plain formed by the Sabarmati, Mahi, Narmada and Tapti rivers. Physically the mainland can be divided into the coastal area, the plains proper and the eastern highlands.

From the river Damanganga in the south to the Gulf of Kutch in the north, and along the southern borders of Ahmadabad District is a narrow fringe of waste land delimited by the tidal waters of the numerous parallel streams that flow through Gujarat. It is a region of salt and marsh, built up by the sea and rivers, at present little used for cultivation. The southern region of the narrow coastal belt stretching from the river Damanganga to the river Kim is a barren stretch of sand-drift and salt-marsh, fringed here and there with small hills. The water is brackish. There is, however, some fresh water near Surat. Towards Broach, the coastal belt broadens and becomes fertile enough to be good

pasture-land. The Gulf of Cambay region is a vast salt-marsh flooded by spring-tides. The water is very brackish. The rivers Sabarmati and Mahi deposit vast quantities of silt in the Gulf. The region around the Rann of Kutch is another salt-waste merging into the rocky interior of Kathiawar on the one side and into the rich cotton soil of Bhal on the other. The Sabarmati flows through Bhal, sluggishly depositing alluvium and making the soil fertile.

The plains of Gujarat, which form the richest part, are divided into southern, central and northern regions. In Broach and Surat Districts the plains are somewhat lost in the eastern highlands. Towards the north the land is fertile, consisting of deep loam, and is level in aspect. The beds of the streams are very fertile, especially in Broach District. The central plains, comprising of Baroda, Kaira and Ahmadabad Districts, are broad and fertile. In the Baroda area there is black soil on the south and a good deal of sand and loam on the north, while in Kaira the alluvial deposits of the Mahi and its tributaries make the plains rich. The Ahmadabad plain is a monotonous one covered with the soil of *bhal* and occasionally subject to flood. Further north, the Viramgam plain is flat but also subject to flood in the monsoon. To the east the northern plains rise gradually and hills sink once again into a plateau in Banas-Kantha and Sabar-Kantha Districts.

The north-eastern hills consist of the outliers of the Aravalli system, the Vindhyas, the Satpuras and the Sahyadris.

B. Aim and scope of exploration

During the years 1954 to 1958, the peninsulas of Kathiawar and Kutch and a part of the mainland from Mehsana in the north to Surat in the south were explored by the author in order to locate Harappan sites, if any. The incentive was provided by the encouraging results of the excavations at Rangpur and Machiala-Mota and the surface-finds from Vaniavadar. Whereas Machiala-Mota yielded pottery analogous to the Lustrous Red Ware of Rangpur III, two other sites, viz. Vaniavadar near Amreli and Wasai near Jamnagar, had yielded red and buff wares of the Late Harappa period. This suggested that the two main ceramic industries of Rangpur had a wider distribution than had been supposed to be the case. It was also visualized that before reaching Rangpur the Harappans should have made settlements along a land- or sea-route followed by them while moving from Sind to Kathiawar. If such settlements could be traced, it was thought, more light could be thrown on the cultural equipment of the Harappans in different Phases of their expansion over space and time.

Normally, one has to pass through the Wadhwan Gateway in the north-east to reach the peninsula of Saurashtra from the mainland. So it was decided to survey the Bhal-Nalkantha area in the first instance following a major river-system where the Harappan settlements were expected. The Sabarmati forms the main drainage-system of the corridor that connects the mainland with the peninsula. The upper reaches of the Sabarmati river are hilly where Harappan settlements could not be expected. A village-to-village survey of the lower reaches of the Sabarmati and its tributaries, especially of the region between Dholka and Rangpur, resulted in the discovery of Lothal, Koth and other Harappan and Late Harappan sites (fig. 1, p. 4). Several small Late Harappan settlements were noticed around Rangpur, but towards Limdi and Surendranagar no Harappan settlement could be located. A thorough survey of the most probable route from the mainland to the peninsula, viz. the narrow passage between Surendranagar and Viramgam, yielded only negative evidence, indicating thereby that the Harappans had not reached so far north in the early days. Between the ancient port of Jhinjhuwada and Halvad on the north

coast of Saurashtra, no Harappan settlement was found. Hence, it was decided to explore the central parts of Saurashtra from end to end. Even negative evidence, it was thought, would help to determine the route followed by the Harappans from Sind to Kathiawar. Between Rajkot and Surendranagar not a single site of the mature Harappa culture came to view. On the other hand, a number of small Late Harappan sites were discovered near Jamnagar, as a result of which it became fairly clear that the north-eastern, northern and central parts of Kathiawar did not come under the influence of the mature Harappa culture and it is only at a late stage that the Jamnagar area was occupied by the Harappans. The possibility of the Harappans having followed a land-route had thus to be ruled out. The absence of any Harappan site, early or late, near Viramgam and the presence of early Harappan sites such as Lothal near the Gulf of Cambay and late Harappan sites, such as Amra, Lakhabawal etc., near Jamnagar, suggested that a sea-route was followed by the Harappans. Further exploration of the western and southern coastlines of Kathiawar established that most of the Harappan settlements, early or late, were first made on the coast. Among them sites near Porbandar, Veraval and Kodinar are important. Later on, the Harappans moved further interior to Rojdi, Babarkot, Gop, Vaniavadar, Adkot and Akrau (fig. 1).

In the following pages a rapid survey of the sites discovered in the course of a village-to-village exploration undertaken by the author between 1954 and 1958 has been made. Reference is also made to the discoveries made by the late P. P. Pandya. The chief ceramic wares and lithic implements picked up from surface are mentioned with a view to indicating the potentialities of the sites. The sites along the coastline are described first, as they provide the necessary background for understanding the movement of the Harappans from the coast to the interior.

A list of protohistoric sites in Gujarat and Kutch showing the cultural period to which they belong is given in the Appendix (pp. 205–07)

C. Kathiawar

(i) *Sites on the coast*

Lothal.—It is the name of an ancient mound in Saragwala village of Dholka Taluka in Ahmadabad district. It is four miles from Bhurki, a railway-station on the Ahmadabad-Botad line. By road it is 50 miles to the south of Ahmadabad. The site was discovered in November 1954, and excavation was started in February 1955. Since then excavation has been carried out year after year. The oval-shaped mound rises gradually to a height of 18 ft. from the surrounding area. Sandwiched between the Sabarmati and Bhogava rivers, the site is subject to sheet-flooding, with the result that the foot of the mound is considerably silted up. The superficial part of the mound, therefore, appears much smaller in size than the original township. Five Phases of structural activity are distinguished in a total habitation-deposit of 21 feet. The first four Phases are assigned to Period A, which represents the true or mature Harappa culture and the fifth to Period B representing the late or degenerate Phase of that culture. Each structural Phase is distinguished from the other by an intervening layer of flood-borne débris.

As revealed in the excavation, Lothal was originally a small village with mud-brick houses protected against floods by a peripheral mud-wall. Perhaps, when the Harappans arrived here they found the indigeneous people using the bowl and jar of micaceous red ware, coarse grey ware and black-and-red ware, which were distinct from the Harappa wares in fabric, shape and treatment. The excellent harbour, easy access to the hinter-

land and the fertile alluvial plains growing cotton, rice and wheat must have attracted the Harappans to Lothal in *circa* 2450 B.C. The prospect of developing the local bead-industry and controlling the source of cotton and ivory, which were in much demand in the west, must have been an additional inducement to the sea-faring Harappans to establish a colony at the place. They not only introduced their superior ceramic, metal and lithic equipment but adopted some of the local ceramic forms for their daily use. Thus, we find the bowl with stud-handle in micaceous red ware as well as the Harappa red ware. This was not long before the village was destroyed by one of the floods of the Sabarmati which used to flow very close to the present mound. Determined to meet the danger bravely, the inhabitants devised measures to protect their settlement against flood. They built the entire township in Phase II over massive platforms of mud-bricks and clay, 4 to 12 feet high. The township was divided into several blocks covering an area thrice as much as before. The town was well-planned and maximum civic amenities known to the age were provided. But for a leader who could organize a co-operative effort, massive structures, such as the platforms, peripheral walls, dock and ware-house, could not have been built. Apparently, in the process of expansion and planning, an acropolis was also built for the ruler who enforced municipal laws and trade-regulations, besides collecting taxes and maintaining public works. Two parts of the town, viz. the acropolis and the lower town, are easily distinguished. The acropolis consists of three blocks. Several houses with bricked-paved baths were built on the central block. In one of the streets a row of twelve baths connected with a public drain suggests the existence of an equal number of houses. An underground public drain is flanked by two rows of houses. The main street in the lower town is also flanked by houses (pl. XLVI). The manholes and soakage-jars in the streets, the control-holes provided to prevent the choking of drains and the screening arrangements in the cess-pools (pl. XLVII) indicate that the Harappans had perfected the science of sanitary engineering. Coppersmiths, shell-workers, goldsmiths and merchants, engaged in foreign trade, lived in the lower town. Two workshops of coppersmiths and their equipment, such as a brick-lined furnace, stone anvil, terracotta crucibles and copper implements, have been noticed here. Houses were built with mud-bricks whereas baths, drains and cess-pools were built with kiln-burnt bricks. Each house had a verandah, a hall and two to four rooms. The shops had only two or three small rooms.

The most important structure built in Phase II, which continued to be in use in Phases III and IV, is a dock (pl. L A) for berthing ships and handling cargo. A basin measuring 710 × 120 ft., excavated to a depth of 8 ft. and enclosed by walls of kiln-burnt bricks, the maximum extant height of which is 14 ft., received the ships, which were sluiced into the dock through the river-estuary and an inlet-channel at high tide from the Gulf of Cambay. The inlet-channel appears to have been excavated in Phase IV, after the river had suddenly changed its course about a mile west of its original flow channel at the end of Phase III. How exactly the ships entered the dock in Phase II has still to be ascertained. The recent discovery of five anchor-stones in the basin of the dock, the absolute verticality of the walls of the embankment without any provision for reaching the water-level by means of a ramp or flight of steps and the extraordinary salinity of the silt inside the dock prove that the structure was designed to serve as a dock and not a tank or reservoir for storing potable water. The devices for water-locking and for automatic desilting by allowing excess water to escape through a spill-way, the construction of buttress-walls on either side of the inlet in the eastern embankment against the scouring action of water and the provision of solid platforms on three sides to guard against the thrust of tidal waters reveal the great skill of the engineers of Lothal in building the dock. Traditional sailors and the Director of Ports, Ahmadabad, who have examined the structure carefully, have opined that the structure was nothing but a dock. A mud-brick platform, 800 ft. long and 42 ft.

wide, was built adjoining the western embankment for handling cargo. The dock-workers lived in small houses built on the clay platform adjoining the northern embankment.

Another important structure in the acropolis area overlooking the dock is what is considered to be a warehouse or granary. It stands on a 12-ft. high mud-brick platform measuring 165×145 ft. and consists of twelve cubical blocks. There are intersecting passages between the various blocks each of which must have been originally 12 ft. square on plan and 3½ ft. high. At the north end of each passage was a brick-built drain-like groove. Whether it was meant for inserting a door for closing the air-vent or served as a drain is not clear. On circumstantial evidence, the structure may be regarded as having been used for baking clay sealings and other terracotta objects in the passages in Phase IV, if not earlier. The original purpose of its construction might have been different from that of a kiln. Most probably it served as a warehouse where sealed packages of goods received from foreign countries were stacked or unpacked. Perhaps customs were also collected here under the supervision of the ruler. In any case, it must have been a very important structure, to safeguard which against floods an outer platform was also constructed. The presence of rice-husks in the mud-plaster on the cubical blocks need not necessarily mean that bags of rice used to be stacked here. On the analogy of the granaries noticed at Harappa and Mohenjo-daro, some scholars have suggested verbally that the cubical blocks formed the bases of the wooden superstructure of a granary.

Considerable damage was caused to the houses and dock in Phase II, but they were rebuilt immediately in Phase III. A great flood of long duration destroyed the entire township including the dock, thus bringing to an end the prosperity of the inhabitants. It is in Phases II and III that the maximum number of industrial establishments sprang up and sea-borne trade with west Asia reached its zenith. The Lothal folk imported semi-precious stones such as agate, opal, etc. from the Narmada valley and manufactured beads in their factories for export. A bead-factory laid bare in the lower town is found to have a central courtyard with a working-platform surrounded by small rooms for workers. Hundreds of carnelian beads in different stages of manufacture were found there. A circular kiln used for heating the raw material and finished product has also been unearthed near by. Micro-beads of gold and steatite and the characteristic Harappan disk beads of steatite have been found in lage numbers. Although the Harappans are said to have made little advance over the primitive method of casting copper and bronze objects, it must be noted that they used finer instruments than the Sumerians did. For example, the Lothal folk used bronze drills of the augur-type with twisted grooves in addition to the flanged ones and their needles had eyelets at the piercing or the opposite end. Other scientific instruments used were terracotta plumb-bobs, ivory scale and angle-measuring instruments in shell.

A word may be said about the foreign trade between Lothal and west-Asian cities. A circular seal of steatite with two jumping gazelles flanking a two-headed dragon found at Lothal provides unmistakable proof of trade-contact with Bahrain and other islands in the Persian Gulf. The bun-shaped ingots of copper found at Lothal, Harappa and Mohenjo-daro and the Indus type seals from Ur, Kish, Susa, Lagash and Tell Asmar provide a clue to the direct trade-contacts the Harappans had with Ur and other cities before the intermediaries from the Persian Gulf snapped these links.

Lothal and the Indus cities have yielded the 'reserved slip ware', which also occurs at Ur and Brak in Sargonid levels and provides another evidence of trade-links. In return of copper ingots, Lothal must have supplied ivory, chank-shell, stone beads and cotton.

Cubical and conical stone weights and Indus seals and sealings are the most important trade-mechanisms found at Lothal. Two systems of weights, one of which was binary,

seem to have prevailed. The terracotta sealings bearing on their back impressions of packing materials, such as cloth, mats and strings, finally establish that the seals were used for a commercial purpose.

In the field of fine arts the Lothal folk did not blindly copy everything from the Indus valley. Although the major part of their painted ware was treated in the Harappan style, there are a few specimens which reveal a new style of painting noted for its realism, vigour and fine brushwork. Animals such as the stag, deer, cranes and other fish-eating birds formed the subject of a new style (pl. XLVIII). Quite often these animals were depicted in their natural environment and meticulous care was taken to avoid overcrowding and repetition of designs. Vessels painted all over the surface with geometric and linear patterns also occur along with vessels painted in the new style. The arts of engraving, modelling and casting of metal figures made great progress. Steatite seals and terracotta sealings bearing beautiful animal-motifs (pl. XLIX), copper and bronze figurines of dog and hare, copper hair-pin with bird-head, terracotta human and animal figurines including those of ram and horse and a torso of a bearded man with Sumerian features are but a few examples of the various arts practised by the Lothal folk.

Religion does not seem to have dominated the daily life of the inhabitants of Lothal. Neither the typical 'mother-goddess' nor seals with deities such as Paśupati are found at Lothal. On the other hand, several small brick enclosures suspected to have been used for fire-worship and one with remains of animal-sacrifice have been noticed in the lower town. It is only in Phase IV that a brick enclosure for fire-worship was built in the acropolis, which had by then lost its importance.

The people buried the dead in pits occasionally lined with mud-bricks. A unique feature of these extended burials is that three out of seventeen grave-pits contained two bodies each indicating that joint burial was in vogue (pl. L B) in Phase III. The grave-furniture consists of dishes-on-stand and jars of various sizes with rounded bottom and bowls with or without a handle. No burials of the earlier Phases have been found.

Finally, it must be emphasized that Lothal A represents the mature phase of Harappa culture, almost identical with the one noticed in the Intermediate and Early levels of Mohenjo-daro, while Lothal B may be said to represent the sub-Indus culture or a degenerate phase with several evolved Harappa ceramic types, ornaments and lithic tools. The characters on the seals and graffiti on the potsherds from Lothal B also point towards an evolution of the culture as a whole on the same lines as in Rangpur II B and II C. Lothal A is dated 2450 to 1900 B.C. and Lothal B 1900 to 1400 B.C. on the basis of Carbon-14 dates.

KOTH.—Twelve miles north-east of Lothal is a lowlying mound at Koth in Dholka Taluka. Except for a small portion it is greatly disturbed by local residents by digging for alluvium. The pottery from the site is identical with that from Lothal A. The dish-on-stand, perforated cylindrical jar, bowl with short handle, basin, trough and jar-stand are some of the Harappa types in the red ware here. Some of these types can be seen in buff ware too. A complete handled bowl in micaceous red ware is an important find. A 4-ft. thick deposit of flood-loam and fine sand caps an 8-ft. thick occupation-débris of the Harappa period. It is clear, therefore, that a heavy flood of long duration was responsible for the final destruction and abandonment of the site.

KANJETAR.—On the southern coast of the peninsula, 6 miles west of the modern town of Kodinar, there is a small lowlying mound, about 500 ft. square and 6 ft. high. The site is identified with Dvārakā, where Kṛishṇa is said to have stayed for a long time after

he had fled from Mathurā; a stone temple is supposed to mark the spot. A trial-pit sunk in the north-west corner of the mound indicated that the occupation-deposit was more than 8 ft. in depth and that the foot of the mound was silted up. Almost all the Harappa pottery-types and a few evolved ones too in sturdy red and buff wares are encountered here. The painting on pottery is executed in black over red or chocolate over buff. The bichrome ware is also found in small quantities. The types include the bowl with straight sides dish with a short or projected rim with or without a carination and jar with a raised neck.

PRABHAS (SOMNATH).—The ancient site of Prabhas near Somnath situated on the bank of the river Hiranya is divided by rain-gullies into five mounds, all of which must have once formed a continuous habitation-site. The results of the joint excavation carried out in the first season by Subbarao and Pandya and continued in the second season by Pandya are noted here.[1]

Five cultural Periods have been distinguished by the excavators. Period I is subdivided into A and B. Prabhas I A is marked by a corrugated, or broadly incised, grey ware which is also burnished. Though analogous in composition to the coarse grey ware of Rangpur II B, the shapes are different. The dish and jar with a bulbous body are the main types from Prabhas I A. The shapes and incised patterns, wherever they occurred, agreed with the shapes and painted patterns on the Late Harappa pottery in Gujarat. The Sub-period was further associated with a microlithic-blade industry of the chalcolithic facies and segmented faience beads. Parallel-sided blades of chalcedony and agate were produced in the crested-ridge guiding-technique. The thinness of the occupation-deposit in Prabhas I A and the continued occurrence of incised designs in I B are said to indicate a continuity of occupation. But Period I B is noted for ceramic shapes and painted patterns of two distinct traditions—' the one representing the late Harappa ceramics of Gujarat consisting of the dish-on-stand, saucepan-handle ' (i.e., bowl with stud-handle) 'etc., and the other by the round bowl with an incurved and bevelled rim, distinctively painted with panelled patterns somewhat similar to the motifs on the chalcolithic painted pottery of central India '. (It is termed ' Prabhas Ware '). ' A commingling of the two was, therefore, indicated, resulting in hybrids; though the Late Harappa shapes and patterns dominated the ceramics, the patterns of the other traditions were often found overlapping the former. Further, a few sherds with paintings in brown on a white or creamy slip suggested some resemblance with the material found in the lower levels at Ahar '.[2] The Prabhas Ware is greenish or mossy-grey in colour, painted in chocolate on a pinkish slip or in pink over a brownish slip. The shapes and painted designs such as wavy lines, stem-and-ball motif and oblique lines in groups provide a clue to the sequential relationship between Prabhas on the one hand and Rangpur II B and II C and Lothal B on the other. The dish-on-stand, bowl with a stud-handle and bowl having straight sides, blunt-carinated shoulder and thick rim painted in black over red as in Rangpur II B and Lothal B occur in Prabhas I B. The conspicuous absence of the goblet, beaker, triangular terracotta cake and even the perforated jar in Prabhas I B on the one hand, and the presence of the Prabhas Ware in Lothal B on the other, have helped to equate Prabhas I B with Rangpur II B and II C. It may also be pointed out here that disk beads of steatite, chert blades and cubical stone weights are not found in Prabhas I B. It is also certain that the Prabhas Ware is an intrusion in Late Harappan settlements in Kathiawar. It does not occur either in Rangpur II A or Lothal A. The

[1] Subbarao, *op. cit.*, pp. 132-34. I am also obliged to Shri P. P. Pandya for the information kindly supplied by him.

[2] *Indian Archaeology 1956-57—A Review*, p. 16.

presence of potsherds painted in brown, violet or black on a white or creamy slip in Prabhas I A may, as suggested by one of the excavators, indicate contact with Ahar.

Period II of Prabhas, which is characterized by the use of the Lustrous Red Ware, is further sub-divided into II A and II B. Whereas in II A the vessels are often painted and their surface is treated with a bright-red slip, the vessels of II B are plain, coarse in fabric and poorer in the treatment of the surface as in Machiala-Mota I. The shapes of the vessels in II A closely resemble those of Rangpur II C and III. Bowls have a sharp-carinated shoulder; dishes are flat; jars have a high neck and the handled bowls have long handles, ' which, together with some painted designs, showed their derivation from the late Harappa '.[1] More sophisticated designs include loops with fronds, hatched diamonds and hatched panels. ' Two sherds were painted with antelope . The pottery tended to be heavy. The only structure of the Sub-period was a rubble pavement. A progressive decline in the lustrous red ware, signified by the dwindling of the carinated bowl and the simplification of decorative motifs to horizontal bands only, finally resulting in the emergence of a plain red-slipped ware '[2] may be noted.

Iron and black-and-red ware are said to make their first appearance in Period III, which is further sub-divided into A, B, C and D. Period III A is characterized by the use of a well-burnished black-and-red ware, the main type in which is a deep bowl with slightly incurved sides. In III B the Northern Black Polished Ware gives a firm datum-line for the early historical period. In spite of the long life of the black-and-red ware in all the four Sub-periods including the pre-N.B.P. Ware levels, it is significant to find that the shapes of the vessels and the treatment of surface are different from those of the chalcolithic black-and-red ware group. There must have been a break in the occupation of the site between the end of the chalcolithic phase and the beginning of the Iron Age.

KINDARKHERA.—To the north-west of Prabhas is a Late Harappan site at Kinderkhera about 10 miles from Porbandar, where dishes-on-stand, dishes, jars with small neck and bowls with handle, all typical of Rangpur II B, are noticed, and the characteristic ceramic types of the true Harappa culture such as the beaker and goblet are missing. The site is assignable to Periods II B and II C of Rangpur on the basis of the ceramic types and painted designs.

At the north-western tip of the peninsula there are several Late Harappan sites near the ancient port of Bedi-Bandar. Among them Wasai, Amra, Lakhabawal, Hariana, Phala, Kota and Narmana, all situated within a radius of 10 miles from Jamnagar, are important. They are small low-lying *tells*, the biggest among them being not more than 300 ft. square. Habitation at these sites started on a rocky bed in the chalcolithic phase and the cultural débris is 4 to 5 ft. thick only. At none of the above-mentioned sites have beakers, goblets, triangular cakes of terracotta, steatite disk beads, chert blades and cubical stone weights, characteristic of the mature Harappa culture, been found. On the other hand, the trough, bowl, dish with or without carination and dish-on-stand form the main ceramic types. The vessels are not carefully treated on the surface. They are indifferently painted in black over red or chocolate over buff as in Rangpur II B. The designs are mostly geometric.

AMRA AND LAKHABAWAL[3].—These two sites were excavated jointly by the Maharaja Sayajirao University, Baroda, and the late Saurashtra Archaeological Department during

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[1] *Indian Archaeology 1956-57—A Review*, p. 16.

[2] *Ibid.*

[3] *Indian Archaeology 1955-56—A Review* (1956), p. 7. I am also obliged to Dr. Subbarao and Shri P. P. Pandya, the excavators, for the information.

the year 1955-56. Lakhabawal is situated 9 miles north-east of Jamnagar. Three cultural Periods, accounting for a total occupation deposit of 8 ft., were noticed here. The non-carinated dish, bowl with stud-handle and trough with a slightly-beaded rim are the main types in red and buff wares in Period I. The inhabitants did not build any drain or platform; nor did they pay any attention to the sanitary arrangements. Chert blades and weights, disk steatite beads, etc., were not in use. On the other hand, the Lustrous Red Ware and black-and-red ware were known. Hence, Period I here may be equated with Rangpur II B and II C. Period II yielded the Red Polished Ware and black-painted red pottery. Period III is still later in date. The mound at Amra situated on a stream 3 miles away from Lakhabawal is very small and the occupation-débris is about 6 ft. only in depth. The sequence of cultures is the same as in Lakhabawal.[2] Period I yielded red and buff wares and bowls of black-and-red ware as in Rangpur II B.[1]

OTHER SITES.—The sites situated behind the coastline or farther interior are mentioned below and their sequential relationship with those situated on the coastline are examined. Four chalcolithic sites within a radius of 5 miles from Rangpur were discovered. Among them Chachana is an important one where cultural débris of Rangpur Periods II B, II C and III is noticed.

The other sites which were not in continuous occupation in Periods II B and II C are small in size. As a sequel to the destruction of Lothal, Koth and Rangpur in Period II A and the consequent dispersal of the population, a number of villages seem to have sprung up around Rangpur in Period II B. Another reason may be that the Harappans living in the lowlying regions near the coast might have migrated to the higher regions in the interior. The refugee influx from the Indus valley may be the third reason. Several Late Harappan settlements are found in the plateau region. Near Rangpur itself there are two important sites, viz. Babarkot and Devaliyo, further upstream on the Bhadar. This brings us to the consideration of sites in the interior.

(ii) *Sites in the interior*

DEVALIYO.[3]—The ancient site situated on the right bank of the Bhadar river at a distance of 6 miles north of Rangpur is about half a mile in length and a quarter mile in breadth. The total thickness of cultural deposit is about 12 ft. At the bottom are two gravel-deposits. The upper one underlying a *kankar*-deposit yields microliths. The Late Harappan deposit is again separated from the microlithic layer by a calcareous deposit. Triangle, point, flake-blade and discoid scrapers are the main tool-types found here. The material used is jasper and agate. Red and buff wares of Rangpur II B type are found in the lower levels and the Lustrous Red Ware in the late levels of the chalcolithic deposit. The handled bowl, storage-jar with a splayed rim and dish with an insignificant carination are the important ceramic types. In the late levels blunt-carinated bowls and high-necked jars are found. The occurrence of microliths with geometric forms unassociated with pottery in pre-Harappan levels at Devaliyo conforms to the Rangpur sequence.

BABARKOT.—At the foot of the Rangpur hills, there is a 15-ft. high mound on the bank of the river Goma near Paliyad railway-station. This site is known as Babarkot, where the bowl with a blunt carination, dish with a beaded rim and jar with a high neck are

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[1] B. Subbarao, *op. cit.*, fig. 36.
[2] *Indian Archaeology 1955-56—A Review* (1956), p. 7.
[3] The name is commonly spelt as 'Devalia'.

found in red and buff wares. The fabric of the vessels is coarse and the types are evolved from Harappa shapes. As such, the site is assigned to Periods II B and II C of Rangpur. There is no evidence of occupation in Period III.

ALAU.—Between Babarkot and Rangpur is another large mound known as Alau, where the protohistoric settlement was of a short duration in the Periods equated to Rangpur II C and III. The cultural débris is 6 to 7 ft. only in depth. The black-and-red ware and Lustrous Red Ware are the chief ceramic industries of the site, the main types being the blunt- and sharp-carinated bowls. The non-carinated dish and high-necked jar also occur. In fact, Alau begins where Babarkot ends. Scrapers of agate and jasper form the lithic implements of the chalcolithic period.

PANSINA.—About 10 miles west of Lothal and on the way to Rangpur, a site assignable to Rangpur Period II B, is located on the dried-up bed of the Bhadar river near the village Pansina in Limbdi Taluka. It is very much eroded by the river. The pottery of the site, comprising the dish-on-stand, trough and globular jar in red and buff wares, indicates a late settlement by the Harappans in Period II B of Rangpur. This is one of the sites of the degenerate Harappa culture occupied in a period of hectic movement owing to the catastrophic flood. The site must have been abandoned before long.

BHIMPATAL.—There is a large mound, earlier in date than Pansina, known as Bhimpatal situated very close to Alau on a tributary of the Bhadar river. The surface-finds consist of scrapers of agate and jasper and Harappa and evolved ceramic types in red and buff wares similar to those of Rangpur II B and II C. The Lustrous Red Ware is found in very limited quantity. The mound is about 8 ft. high, 400 ft. long and about 300 ft. wide. Stray tools of the Middle Stone Age are also noticed in the gravel-bed.

AKRU.—About 15 miles south of Rangpur on the Dhandhuka-Bhavnagar road there is a large mound near the village Akru. It is about 2 furlongs in length, and half a furlong in breadth and rises to a height of 6 to 7 ft. from the surrounding area; but the occupation-débris is at least 12 ft. thick, as can be made out from the pits dug by the villagers. The mound is cut into three separate parts by rain-gullies. In the central part pottery-types analogous to those of Rangpur II B and II C are found underlying deposits of the early medieval period. The dish with or without a carination, handled bowl and convex-sided and blunt-carinated bowl in red ware are the main types. A fragment of a beaker and a chert blade were also picked up. Scrapers of agate, jasper and milky quartz are seen in the river-bed which is now silted up. The typical Lustrous Red Ware of Rangpur III is not encountered here. Apparently the site came to be occupied at the beginning of Rangpur II B and the habitation continued in Rangpur II C also. After a long break it was occupied once again in the early medieval period. Akru must have been an important township in Periods II B and II C. The lithic implements include crudely-worked flakes used as scrapers and a solitary rejuvenated fluted core.

South of Akru near Barvala there is a small low-lying mound known as Pavteswar-Mahadeva near a shrine of the same name. Fine and coarse varieties of red and buff wares collected at the site are analogous to those from Rangpur II B in composition and shapes. The colour-scheme adopted for painting is black-on-red or chocolate-on-buff or green. The buff and pinkish buff sherds form the bulk of the painted wares. It is very interesting to find that though the site is a small one and very much eroded, a large quantity of painted pottery could be recovered. Overfired vessels indicate that it was a potters' settlement. The straight-sided bowl with thick walls, large trough with a splayed rim, carinated dish, dish-on-stand and jar with a small neck are the main ceramic types of the site, which was apparently an important, though small, temporary settlement made by the Late Harappans. The mound is heavily eroded and hence the thickness

of the cultural deposit is about 4 ft. only. The Harappan potters who settled here seem to have moved away after a short stay in Rangpur Period II B.

ROJDI.[1]—Of the three sites discovered by P. P. Pandya, the most important is Rojdi. The lowlying mound near Rojdi village in Gondal Taluka is situated on the left bank of the Bhadar river, a stream larger than the Limbdi-Bhadar flowing near Rangpur. The site is 34 miles south of Rajkot and 15 miles south-west of Gondal. According to the excavator there are two cultural Periods.[2] Period I, which represents the Harappa culture, is subdivided into three Phases, A, B and C. The convex-sided bowl, bowl with straight sides, bowl with a stud-handle, storage-jar with a square rim, perforated jar, dish-on-stand, dish with a flaring or beaded rim, beaker and lamp may indicate an early settlement but in any way not earlier than Rangpur II B. Although the perforated jar, beaker and goblet have survived in small numbers as in the case of Rangpur II B, the very presence of the blunt-carinated bowl, high-necked jar and shallow dish painted with wavy lines in Rojdi I A should indicate that it is later than Rangpur II A. A stray chert blade in Rojdi I or Lothal B only indicates the continuity of Harappan traditions. Other essential features of a mature Harappa settlement, such as the construction of bath-rooms and drains, are lacking in Rojdi, whereas they are found in Rangpur II A. The homogeneous texture of the red and buff wares, application of a fine thick slip and careful execution of painting on vessels are lacking in Rangpur II B as well as in Rojdi I A. The degeneration of the Harappa culture as a whole is thus obvious in Rojdi I A.

Phase I C of Rojdi is noted for the survival of the red ware and the absence of certain ceramic types such as the perforated jar, beaker, etc. The excavator has equated Rojdi I A and I B with Prabhas I A and I B respectively.[3] In terms of the Rangpur sequence Rojdi I A and I B may, therefore, be equated with Rangpur II B and II C respectively. Although Rojdi represents a degenerate phase of the Harappa culture, its importance lies not so much in the ceramic forms or painted designs as in the evidence of the continued use of the Indus script even in the late period. A convex-sided bowl from Rojdi is found to have been inscribed with four Indus characters.[4] The seals from Lothal B and the graffiti from Rojdi and Rangpur suggest that the Indus script survived in a modified form.[5]

ADKOT.—The mound at Adkot, situated on the Bhadar river in Jasdan Taluka, 30 miles south-east of Rajkot, is one of the small temporary settlements made by the Harappan refugees in the late Harappa days. The thickness of the occupational deposit is about 6 ft. Pandya conducted a small-scale excavation here by sinking three trial-pits. The main ceramic wares are the red and buff wares of a coarse fabric. The blunt-carinated and convex-sided bowl, dish-on-stand with or without a carination, perforated jar, bowl with a handle, small jar with a high neck and large storage-jar with a beaked rim[6] are some of the characteristic types of Rangpur II B that occur at Adkot. The painted motifs include the fish and leaf. The imperfect application of the slip, lack of uniform thickness of the lines and conspicuous absence of other typical Harappan objects are indications of a degeneration of the culture. Hardly any brick structure is encountered. There is another mound opposite the bus-stand discovered by the author at Adkot itself, where also Late

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[1] The name is also spelt as 'Rozdi'.
[2] *Indian Archaeology 1957-58—A Review* (1958), pp. 18-20.
[3] *Ibid.*
[4] *Ibid.*, fig. 10 A, *1*.
[5] *Indian Archaeology 1958-59—A Review*, pl. XVIII A.
[6] *Indian Archaeology 1957-58—A Review*, fig. 10 B, *5* and *7*.

Harappa pottery of Rangpur II B and a poor variety of the Lustrous Red Ware are found. This mound is undisturbed.

PITARIA.—About 44 miles south of Rajkot is a small *tell* near the village Pitaria which was excavated by Pandya. Two cultural Periods, the earlier one representing the Harappa culture and the later one the Lustrous Red Ware culture, have been distinguished. The lamp and flat dish of the early period are characteristic of Rangpur II C, while the bowl belongs to Rangpur II B. Other characteristic Harappa tools and ornaments are lacking. The late level of Pitaria is noted for the Lustrous Red Ware.

VANIAVADAR[1].—On the left bank of the river Vadi, a tributary of the Shetrunji, a lowlying mound indicative of a Late Harappa settlement is situated near the village Vaniavadar. The surface-finds are varied. Tools of the Middle Stone Age, such as large scrapers and patinated flakes of basalt, are found in the loose gravel-bed. The ceramic types in red and buff wares include the carinated bowl, dish with a beaded rim and handled bowl. A few straight-sided bowls and carinated dishes also occur. All these evidences suggest a Late Harappan settlement made in Rangpur II B period and continuing into II C also. The most interesting feature is the occurrence of a large number of painted sherds indicating a revival of painted traditions. The lithic implements include short parallel-sided blades of chalcedony and fluted cores. The site must have been re-occupied in the early historical period as is indicated by the presence of the Red Polished Ware.

GOP.—At the foot of the Barda hills, about 35 miles south of Jamnagar, is a Gupta temple at Jilanwari (Jinawali) Gop on the bank of the river Vartu, the name of which is derived from 'Avartika', mentioned in the *Mahābhārata* and the *Purāṇas*. After slaying the demons Mura and Narakāsura, Kṛishṇa is said to have come to Gop where he was bathed with the waters of seven rivers and seven seas to perform a purification-ceremony. The ancient site on the right bank of the river is found to yield red and buff wares, which are not, however, carefully painted or slipped. The ceramic types are of the Late Harappa and Transition Phases. The dish with a beaded rim and bowl with a blunt-carinated shoulder are found here. Gop is, therefore, assignable to Periods II B and II C of Rangpur. In the early historical period the habitation shifted from the right bank to the left where stands the temple. The Red Polished Ware and Kshatrapa and Gupta coins are also found here.

D. KUTCH

In order to ascertain whether the peninsula of Kutch also came under the impact of the Harappa culture an intensive survey was undertaken during the winter months of 1958. The physical features of Kutch have been described previously (above, p. 176). The area east and north-east of Bhuj, especially around Bachau and Rapar, extending up to Adesar, was explored in the first instance, but no Harappan site came to notice. Even in early historical times, no important settlement seems to have been made in this hilly tract. On the basis of this negative evidence the coastal belt was taken up for survey. A start was made with Kandla and Mundra, and after exploring the coastal strip between Mandvi and Jhakau, the survey was extended to Lakhpat and Bet. Six settlements of the Harappa culture were discovered in the course of the survey. Besides these, seven sites of the Rangmahal culture[2] also came to notice. Among the Harappan settlements Desalpur and

[1]The name is commonly spelt as 'Venivadar'.

[2]The sites of the Rangmahal culture are Godhra, Munda, Jora, Dhumai, Sankhanar, Parjan and Saran.

Samagogha in Nakhtrana Taluka are earliest, the rest being Late Harappan. Katesar and Luna in Bhuj Taluka, Luna in Mandvi and Todio near Kathara are assigned to Rangpur II B. Samagogha yields pottery of Rangpur II C also.

DESALPUR.—As the Rann of Kutch was navigable by large ships even in the time of the author of the *Periplus*, there should have been no difficulty in doing so in protohistoric times. In the absence of any evidence of the Harappans having moved down the Nara, a tributary of the Indus, it should be presumed that they reached Desalpur by a sea-route. Desalpur is situated near Gunthri in Nakhtrana Taluka on the bank of the river Morai which disappears into the Rann of Kutch . The mound is heavily eroded by floods. The occupational deposit is about 10 ft. in depth and the section exposed by the river reveals rubble walls in the lower levels. Sturdy red and buff wares treated with a fine slip and painted in black over red or chocolate over buff are found in large quantities. The cylindrical perforated jar, dish with a projected rim, dish-on-stand, 'S'-shaped vessel, trough, basin, beaker and convex-sided bowl are the main Harappa types recovered from surface. The site also yielded characteristic Harappa tools and ornaments, such as the parallel-sided blades of chert, disk steatite beads, faïence bangles, etc. Owing to its proximity to Mohenjo-daro, Desalpur assumes great importance from the point of view of cultural expansion. Though a small settlement, it reveals the same homogeneity of mature Harappa culture as is noticed throughout the Indus valley and at Lothal in Period A. There does not appear to have been any later occupation, not even in the Late or Transition Phase of the Harappa culture after the mature Harappa settlement was destroyed by floods. A thin deposit of sand and silt caps the Harappan occupational débris. The surface-layer is weathered. This site is next in importance to Lothal and a systematic excavation here is called for.

E. OTHER PARTS OF GUJARAT

It is necessary to turn for a while to the mainland. The corridor between the peninsula of Kathiawar and the mainland was surveyed in 1954-55 and again in 1958 with a view to locating Harappan sites, if any, and to determine whether the Harappans made any effort to colonize the mainland and if so when. The lowlying area between Jhinjhuwada and Lothal was explored for early Harappan sites along the supposed extension of the river Saraswati up to the Gulf of Cambay. The negative evidence proved that the Harappans did not pass through the lowlying marshes and swamps.

KANASUTARIA.—About 25 miles north of Lothal there is a mound known as Kanasutaria near the village Chhabasar in Dholka Taluka. Recent wind-blown sand has completely covered the protohistoric remains. Incidentally a tractor cut across the mound and threw up mud-bricks, sandstone weights, sling-balls and painted pottery. A cultural débris of 6 to 8 ft. was noticed. The chief ceramic wares of the site are the Lustrous Red Ware, red and buff wares of coarse fabric and black-and-red ware. Most of the ceramic types are similar to those of Rangpur II C and III. The bowl with a sharp or blunt carination, shallow dish with a beaded rim and stemmed bowl are the main types. In the sections of the pits dug near the mound by the local residents for collecting sand, microliths were found. A trial-pit revealed a 2-ft. thick deposit of coarse sand and pebbles at the bottom, succeeded by fine river-sand with microliths such as trapezoids and flake-blades of chalcedony and milky quartz unassociated with pottery. This layer is in turn succeeded by buff *kankar*, which underlies a deposit of alluvium and fine sand locally called *muram*. It is capped by a 3-ft. thick layer of black clay over which the chalcolithic settlement took place. It is, therefore, evident from pottery and stratigraphical evidence that Kanasutaria came to be occupied very late in the Transition Phase of the Harappa

culture. The occupational débris is completely covered up by loess. Formerly a major river must have been flowing near Kanasutaria, as is borne out by a thick fluviatile deposit of sand and gravel.

SUJNIPUR.—North of Ahmadabad, protohistoric sites cannot be easily located because of the enormous accumulation of loessic sand in recent times. A small mound could, however, be located at Sujnipur near Patan, the medieval capital of Solanki rulers, on the bank of the Saraswati river. The surface-finds include the dish-on-stand in red ware, bowl in black-and-red ware and deep-carinated bowl without lustre and parallel-sided blades of chalcedony with fine crested guiding ridge. The lustre on the surface of the earthenware is very poor. By the time the Lustrous Red Ware folk of Gujarat moved up to Sujnipur in the post-Harappa period, the technique of decorating the vessel-surface by burnishing had ceased to be popular. However, the shapes and composition did not change much. A contact between the successors of the Harappans in Gujarat and their contemporaries in central India and the Deccan is suggested by the occurrence of the Lustrous Red Ware and associated ceramic types at Ahar, Navdatoli, etc. Kanasutaria and Sujnipur are two intermediate stations of the Late Harappans on their northward march from the peninsula to the mainland.

THE NARMADA AND KIM ESTUARIES.—The discovery of Lothal in 1954 extended the zone of the Harappa culture as far south as the Gulf of Cambay. It also increased the possibilities of the Harappans having moved farther south. Perhaps ancient ports such as Broach (Barygaza or Bhṛigukachchha) on the west coast of the mainland mentioned in Epic literature and by Greek writers served as ports of call for Harappan ships also. A survey of the estuaries of the Narmada and Kim rivers was, therefore, undertaken in the latter half of 1957 with remarkable results.

The Narmada river is known to have changed its course several times before, as a result of silting up of its mouth. Recently, in 1955, when the river was in spate, an area of several hundred square miles was submerged. The floods in the Tapti in 1959 played havoc with the city of Surat and wiped out of existence several villages in the estuary. Early historical sites such as Nangal and Ankleswar were destroyed in the past by the Narmada, not to speak of the protohistoric sites. A detailed survey of the coastal strip between Dahej and Jetalsar and a hurried survey up to Kavi brought to light five sites belonging to different phases of the Harappa culture. Among them a Late Harappan site at Mehgam in the Narmada estuary and a site of the mature Harappa culture at Bhagatrav near Jetpur in the Kim estuary are important from the point of view of the coastal movement of the Harappans.

Mehgam[1].—The island of Aliabad affords necessary protection to small ships entering the creek near Mehgam village where the Narmada joins the sea. The ancient mound near the village is almost completely eroded, only the fringe of the once-extensive Late Harappan settlement being left. A few potsherds strewn here and there provide a clue to the ancient habitation. In one of the trial-pits sunk on the slopes in June 1957 was brought to light some *pise* enclosing a small pit in which two high-necked jars, a dish-on-stand and a flat dish were found placed. The contents of the jars had decomposed and the skeletal remains must have been washed away by tidal waters. The contents of the pit showed that the dead had been buried here. The jar with a raised neck painted in black over red, dish with a beaded or projected rim, dish-on-stand and bowl are among important ceramic types recovered from the grave.[2] A carnelian bead and a terracotta biconical bead were

[1] Commonly spelt as 'Mehegam'.
[2] *Indian Archaeology 1957-58—A Review*, p. 15.

also among the grave-goods. Mehgam must have been a port in the Late Harappa period contemporary with Rangpur II B.

Telod.—Telod is a small lowlying mound on the south bank of the Narmada opposite Mehgam. Heavy storage-jars and bowls with straight sides similar to those from Rangpur II B were found here also. The chief ceramic industry of the site is the sturdy red ware painted in black over red. The jars with a projected rim, however, shows a rough surface. Other pottery-forms such as the bowl with straight sides indicate that Telod must have been a Late Harappan settlement contemporary with Mehgam. The second wave of migration from the Indus valley might have been responsible for the temporary settlements at Mehgam and Telod.

Bhagatrav.—The southernmost Harappan settlement known so far is the mound locally known as Bhagatrav near Jetpur village in Hansot Taluka of Broach District. It must have been an important port contemporary with Lothal. The Kim river and backwaters of the sea entering the creek have eroded the mound so much that only traces on the peripheral region can be seen now. For eight months in the year the mound is not approachable from Jetpur or any other side, as it is surrounded by water. The present height of the mound is about 8 ft. and the trial-pits made at two places on the periphery revealed a habitational deposit of 7 ft. Two cultural Periods could be made out in the course of the excavation. Period I is divided into two Sub-periods, viz. I A and I B, the former representing the mature Phase of the Harappa culture and the latter the late Phase. The deposit of I A is about 4 ft. and I B about 2 ft. Period II represents a medieval habitation. The red and buff wares of Bhagatrav I A are sturdy and well-treated. The painting is executed in black over red and chocolate over buff. Characteristic Harappa types, such as the dish-on-stand, dish with a carinated shoulder and expanded rim, heavy jar with a projected rim, basin, convex-sided bowl and handled bowl, are encountered in considerable numbers in Period I A. Only two fragments of goblets and three beakers were recovered. The black-and-red ware occurs in small quantities. Other objects of the Harappa culture noticed in Bhagatrav I A are parallel-sided blades of chert, a disk bead of steatite, biconical beads of carnelian and faïence, a terracotta figurine of humpless bull and copper objects of indeterminate shapes. From the foregoing ceramic and other evidences it can be concluded that Bhagatrav I A is slightly earlier than Rangpur II A and is perhaps contemporary with Phases II and III of Lothal A. Bhagatrav I B yields Late Harappa wares, especially the dish and jar, similar to those from Mehgam and Rangpur II B. From Bhagatrav II comes a coarse grey ware assignable to the tenth-eleventh century A.D.

Hasanpur.—Near Bhatgaon in Hansot Taluka there is a 6 ft. high mound at a place known as Hasanpur. The main ceramics of the site are the Lustrous Red Ware, coarse grey ware and black-and-red ware. The dish with a beaded rim, bowl with a sharp-carinated shoulder, high-necked jar and dish-on-stand are the main types encountered. In black-and-red ware too the carinated bowl is found. Hasanpur is, therefore, equated with Rangpur II C and III.

The sequence of cultures of the protohistoric period of Kathiawar is repeated in south Gujarat as follows:

Bhagatrav I A	=	Rangpur II A
Bhagatrav I B Mehgam Telod	=	Rangpur II B
Hasanpur	=	Rangpur II C Rangpur III

F. Summary of the results

It is necessary now to take stock of the results of the explorations in Gujarat and excavations at Rangpur, Machiala-Mota, Lothal and Bhagatrav and see what bearing they have on the survival and spread of the Harappa culture in west India.

The first Harappan settlement in Kathiawar made at Lothal near the Gulf of Cambay was contemporary with the cities of Harappa and Mohenjo-daro. It was not a mere trading-centre or *entrepot* but a full-fledged port-town which owed its prosperity to overseas trade. Its geographical position and the rich cotton- and wheat-growing hinterland attracted the seafaring Harappans. But the recurring floods in the neighbouring rivers were a great menace to the town. One of the floods, in *circa* 2000 B.C., seems to have forced some of the residents of Lothal to move farther interior, to Rangpur, Koth and other places. About this time two other Harappan towns came to be established, one farther south of the Gulf of Cambay at Bhagatrav in the Kim estuary and another at Desalpur in Kutch. Thus by 2000 B.C. the Harappans had not only trade-contacts with Kutch, Kathiawar and south Gujarat but also developed Lothal into an important port-town and trading-centre. In the course of their southward movement from the Indus estuary they seem to have followed a sea-route and made settlements on the western seaboard of India extending down to Surat. Even later, when the Harappans had to leave the Indus valley in a hurry, they came by a sea-route and made several temporary settlements on the coastline. The conspicuous absence of sites of the mature Harappa culture in the corridor connecting the peninsulas of Kutch and Kathiawar with the mainland lends support to the view that the Harappans did not follow a land-route. The second point to be noted is that though the Harappans devised several measures to save their townships from floods, they could not withstand the onslaught of a second great flood in some of the rivers in Kutch and Gujarat in *circa* 1500 B.C. Some of the early Harappan settlements became extinct, while others appear to have been partially saved. Flood-borne débris in the form of silt, sand, brickbats and rolled potsherds has been found in enormous quantities at Lothal and Rangpur. Desalpur had to be abandoned once for all, for there is no evidence of the re-occupation of the site in the Late Harappa period. A 3- to 4-ft. thick deposit of river-silt and sand over Harappan occupation-layers at Koth near Lothal proves beyond doubt that the flood must have been of long duration in Kathiawar. So was probably the case in the Indus valley too. A high hill of silt left at Budh-Takkar in Sind is considered as an evidence of a great flood of long duration in the Indus river.[1] The extensive platforms of mud-bricks at Harappa, Lothal and Rangpur and the mud-brick fillings within the high plinth-walls of the houses at Mohenjo-daro are evidences of the measures taken by the inhabitants of these towns to keep their dwellings above the normal flood-level. The mud-brick walls of Lothal could not have been defences against invading forces but only protective measures against recurring floods. The excavators, Vats,[2] Mackay[3] and Marshall,[4] have testified to the dangers of flood to which Harappa and Mohenjo-daro were subject. Wheeler[5] also points out the dangers of inundation to which Harappa was exposed. The fluviatile deposit, about 40 ft. high, at Budh Takkar shows that the Indus valley was converted into a huge lake as a result of heavy rains and floods in the rivers. This unprecedented flood must have forced the Harappans to run for life in different direction

[1] M. R. Sahni, *Man in Evolution* (Calcutta, 1952), pp. 153-54.
[2] Vats, *op. cit.* (1940), I, p. 7.
[3] Mackay, *op. cit.* (1938), I, p. 63.
[4] Marshall, *op. cit.*, I, pp. 5-6.
[5] Wheeler, *op. cit.* (1947), p. 66.

from the lowlying areas of the Indus valley. From Mohenjo-daro they seem to have rushed towards Gujarat and made temporary settlements on the coastal belt, as is borne out by the presence of small Late Harappan mounds at Todio in Bhuj, Amra, Lakhabawal, Phala, Hariana, etc., near Jamnagar, Kindarkhera near Porbandar, Prabhas near Somnath, Kanjetar near Kodinar and Mehgam near Broach. These sites have yielded characteristic Harappa ceramic types of degenerate fabric. Simultaneously with the Indus valley cities, Lothal and Koth were also destroyed by flood, whereupon the inhabitants moved towards higher places for a while but returned to their settlements especially at Rangpur and Lothal after the recession of the floods, thus accounting for Late Harappan settlements at both the places. A few new settlements also sprang up around Lothal and Rangpur.

Thus, it is evident that the Harappans came in two different waves. The pioneers came in *circa* 2450 B.C. in limited numbers for trade or colonization and settled down first at Lothal and subsequently at Rangpur, Desalpur and Bhagatrav. The second wave was perhaps a sudden influx of a large number of refugees who had to vacate the Indus valley in a hurry. After landing at the estuarine ports they made small but temporary settlements at Todio, Mehgam, Amra, Lakhabawal, Kindarkhera, Somnath, etc. Having lost everything, they had to start from a scratch and live in poorer conditions for a fairly long time. During these days of unsettled life they could not think of all the material comforts of life which they had once enjoyed, not to speak of objects of art, amusement, etc. They could not import raw materials, such as chert, steatite, etc., and lived in small villages, depending mostly on agriculture and cattle-rearing. Hence the refugee-settlements were small, with mud-brick houses where no drains or brick-paved floors existed. The overall control effectively exercised by a political authority over vast areas suddenly disappeared. The refugees living in small groups in different parts of Gujarat ceased to have contacts with each other. Even the re-occupied towns, such as Lothal and Rangpur, shrank in size to a very large extent. The houses were shabbily constructed more on the lines of an ill-planned village than a large well-planned town. It must be noted at the same time that there are no indications of any new ceramic tradition being thrust on them by any alien culture during this period. In course of time the refugees moved from the small coastal settlements towards the plains and hills in the peninsulas and finally reached the mainland. They also enlarged their villages into small towns wherever they continued to live for long especially in the Transition Phase. It is during this Phase that they were a migratory folk, coming in contact with other culture-groups and borrowing occasionally a new ceramic type or a painted motif. They had to adapt themselves to new circumstances.

In spite of the catastrophic flood and the consequent decline in the material prosperity of the Harappans, the very vitality of their culture helped them in reviving some of the earlier ceramic traditions and developing new ones which were largely dependent upon local conditions and the available raw material. The shapes of beads and other ornaments, copper and bronze tools and even ceramic wares of the post-flood days were an exact copy of the original Harappan shapes for a fairly long time. In course of time, however, new shapes were evolved. The lithic tools depended upon the local raw material. Short parallel-sided blades of chalcedony were used at Machiala-Mota instead of ribbon-flakes of chert. At Rangpur and Devaliyo, where chert is not available, jasper and agate were used for making scrapers instead of blades. In the absence of steatite, terracotta and agate beads analogous in shape and finish to the steatite and faïence beads of the earlier times were used for personal decoration. The Lustrous Red Ware folk revived the technique of inverted firing and produced vessels of the black-and-red ware on a larger scale. Many of the characteristic Harappan motifs continued to be painted, but the overall painting on

the vessel-surface was dropped. There is a marked tendency to stylize motifs, several of which ceased to be combined in a schematic way. Some of the Harappan ceramic types were in use side by side with the newly-evolved shapes. Spheroid weights of granite or dolerite, which were in use in the earlier Period, continued to be in use later too, but the cubical weights of agate and chert disappeared owing to the non-availability of the material; there was, however, no radical change in the standard of weights. Even the graffiti on potsherds from Rangpur II C and III bear close resemblance to the Indus signs. Thus, it is evident that the Harappa culture was not destroyed by natural calamities or human foes even though its cities and villages were destroyed by the former. The culture as such survived in a different garb all over Gujarat and in parts of the Indo-Gangetic basin itself. Perhaps in the course of their eastward movement the Harappans came across earlier settlers of the less-developed regions with whom they exchanged goods and ideas.

It would be entirely wrong to say that the Lustrous Red Ware suggests a new people from outside the subcontinent. The Lustrous Red Ware is not found in the Indus valley or at the Mesopotamian or Baluch sites. It was locally evolved by a slow process from the decadent Harappa red ware over a period of nearly five centuries. The bulk of the painted designs is Harappan or is evolved from it. Out of sixty important motifs not more than three or four can be said to be due to outside contact. Most of the ceramic types are also evolved from the Harappa types. The metal tools and weapons used by the Lustrous Red Ware folk are essentially Harappan in character.

4. RANGPUR IN RELATION TO OTHER CHALCOLITHIC SITES

A. The Indo-Gangetic region

Very important discoveries have been made in the course of the last twelve years as a result of the explorations and excavations undertaken by the Archaeological Survey of India in the Ghaggar and Sutlej valleys and in the Ganga-Yamuna *doāb*.

North Rajasthan.—During the years 1950-53 A. Ghosh[1] was able to locate as many as thirty sites of Harappa and allied cultures in Suratgarh and Anupgarh Tahsils of Ganganagar District of north Rajasthan, along the dried-up beds of the rivers Sarasvati and Dṛishadvatī of ancient literature. Among them the site of Kalibangan is the largest. The current excavation here[2] has revealed that the Harappa culture was in the lower part overlapped and, as a whole, preceded by an antecedent culture.

Rupar.—This is a fairly extensive mound on the banks of the river Sutlej near Kotla Nihang in Ambala District of Panjab. It was excavated from 1952 to 1955 by Y. D. Sharma. Its importance lies in that it suggests a north-east movement of the Harappans and further establishes that the Harappa culture preceded the Painted Grey Ware culture. What is more important is the clear break in the occupation of the site between the Harappa and Painted Grey Ware cultures, establishing thereby that the Painted Grey Ware people were in no way responsible for the destruction of the Harappan settlement. Here 'two main Phases were indicated in the deposits of the Harappa culture. The lower Phase represented a late phase of the mature Harappa culture, while the upper one offered certain new traditions in ceramics. For example, while the typical Indus goblet with

[1] A. Ghosh in *Bulletin of the National Institute of Sciences of India*, I, no. 1, pp. 37-42.
[2] *Indian Archaeology 1960-61—A Review* (1961), pp. 31-32.

pointed bottom was already rare in the lower Harappa levels, in the upper levels it was almost absent. Terracotta cakes became scarce in the upper deposits, where, however, certain characteristic incised designs on pottery appeared.'

BARA.—At Bara, not far from Rupar, further degeneration in the Harappa culture as a whole is noticeable, it 'was still occupied when Rupar had been deserted by the Harappans, for here the Indus goblet was represented only in the lower levels, and that too by hardly half a dozen sherds.' Terracotta cakes were scarce here. There was, however, a diversity in slips and paintings and some of the pottery-shapes are also found to be new.[1] The parallel development in the last days of the Harappans in the Sutlej valley as in Kathiawar is most striking. In Rangpur II A and Rupar I all the characteristic Harappa types are found but the goblets and beakers occur in very small numbers. They almost disappear excepting for a couple of sherds of each type in the late levels of Bara and Rangpur II B.

ALAMGIRPUR.[2]—Among the latest discoveries is a small low-lying mound in the Ganga-Yamuna doab near the village Alamgirpur, 17 miles west of Meerut. It is situated on the Hindon river, a tributary of the Yamuna. The total occupation-débris is about 12 ft.

There are definite indications of the Harappans and their successors having settled down in the earliest levels of Alamgirpur. But they did so during the period of disturbances when they had to leave the Indus valley and move eastwards. The pointed goblet, beaker, dish- and bowl-on-stand, perforated jar, terracotta triangular cakes, steatite micro-beads and segmented faïence beads are indications of Harappan affinity in the culture. But a little more detailed examination reveals that the maturity of the culture is lacking and a degeneration had set in. Fashions were gradually changing and new traditions were being introduced. The following points are of interest. Only two fragments of the perforated jar and very few goblets have been found. Heavy storage-jars, so characteristic of mature Harappa culture in the Indus valley and Gujarat, are totally missing. The vessels are not treated with a fine thin red slip except in a few cases. Chert blades and tubular carnelian beads are also unknown. On the other hand, the evidences are in favour of a Late Harappan settlement comparable with Rangpur II B and even II C. The bowl with blunt-carinated shoulder painted in groups of oblique lines, high-necked jar with bulbous body, jar with globular body painted in groups of flowing vertical wavy lines, exactly as in Lothal B, dish with non-carinated shoulder and dough-plates bearing graffiti similar to the signs on steatite seals from Lothal B are just a few examples of the changes in the ceramic forms and painting-traditions which had taken place by the time the Harappans reached Alamgirpur. It also confirms the author's findings that the Harappans moved in different directions from the Indus valley and made small temporary settlements. In course of time the various groups of Harappan refugees lost contact with each other and evolved new ceramic forms and painted motifs and new types of ornaments, tools and weapons depending upon various factors including the nature of the material locally available.

THE INDUS VALLEY.—One of the problems concerning the Harappa culture which has greatly intrigued the scholars is the cause for the destruction of the Indus valley cities. Another question that has remained unsolved is the identity of the successors of the

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[1] I am obliged to Dr. Y. D. Sharma for the information kindly furnished by him. [The whole evidence has to be re-assessed in view of the discovery of pre-Harappan material at Kalibangan.—Ed.]

[2] *Indian Archaeology 1958-59—A Review*, p. 50.

Harappans. Stuart Piggott[1] has tried to show that frequent invasions from the north-west of the barbaric Aryan tribes, unsympathetic to the urban civilization, were responsible for the destruction by fire as evidenced by the thick layers of ash found in the Rana-Ghundai excavation. The hoard of jewellery and weapons at Mohenjo-daro is said to indiate a period of insecurity during the last days of the city. Wheeler opines that it is the Cemetery H people at Harappa, idenıified as Aryans, who were responsible for the destruction of Harappa.[2] It is necessary to examine briefly some of the arguments before accepting or rejecting them. The Harappan empire was very vast and the important cities and towns such as Harappa, Mohenjo-daro and Lothal must have been administered very efficiently. Any attack on the villages lying on the outskirts of the vast empire should not be supposed to indicate the downfall of the empire as a whole. Small villages such as Rana-Ghundai, situated on the outskirts of the Harappan empire, might have been subject to sporadic attacks by hill-tribes, but this should not lead one to the conclusion that all the cities and towns including Harappa, Mohenjo-daro and Chanhu-daro were destroyed by the barbaric tribes. It is only when the political and commercial centres of an empire are attacked and destroyed that the invaders can be said to have been successful. At least the evidence available at Harappa, Mohenjo-daro and Chanhu-daro is not enough to establish an invasion theory.

The main body of evidence adduced by Piggott in support of his theory of destruction of the Indus valley cities by Aryan tribes comes from Chanhu-daro II, where reminiscences of the Jhukar culture have been found. It is therefore necessary to examine the evidence from Chanhu-daro also. It is a settlement of ' squatters ' among the Harappan ruins of I C Phase of Chanhu-daro and has a curious and distinctive assemblage of material equipment, such as pottery head-rests, circular stamp-seals of pottery, faïence, stone and metal and bone awls. Painted pottery, beads and amulets are other important finds. But the introduction of new elements need not necessarily mean that the Harappan settlement was destroyed by the invading forces. On the other hand, the flood-borne stratum overlying I C Phase of Harappan occupation clearly shows that the destruction of Chanhu-daro I C was due to flood. Mackay, the excavator, has emphasized more than once that Chanhu-daro was subject to frequent floods and that at the end of each of the three Phases of Harappan occupation, viz. I A, I B and I C, the township of the Harappa period was destroyed by flood. ' From the evidence afforded by objects unearthed in and outside their houses ', says Mackay, ' there is no doubt that the summit of the Mound I was occupied to the last by people of the Harappa culture. These people probably *lingered here until they gradually died out or left, family by family, to join more prosperous communities elsewhere. It is not impossible that the flooding of the country by the Indus was so extensive, so frequent, and so prolonged each time that the later inhabitants of Chanhu-daro were forced to make their way to lands of higher elevation where they lived until their identity was lost and they became merged with people of a lower status of civilization.* I am inclined to think that they retreated towards the east, for the hilly regions to the north and west would have had little attraction for an urban people accustomed to the comparative security of the plains.'[3]

At this stage we may examine whether the Late Harappa culture of Rangpur II B had any contact with the Jhukar culture. In the Jhukar Phase of Chanhu-daro Harappa ceramic types, such as the dish-on-stand and dish, continued to be in use. The buff ware is buff-slipped but occasionaly an additional red or pink slip is also used. The most

[1] Stuart Piggot, *Prehistoric India* (Harmondsworth, 1950), pp. 210 ff.
[2] Wheeler (1947), p. 82.
[3] Mackay, *op. cit.* (1943), p. 63. The italics are of the present author.

striking feature in the treatment of the surface of the vessels is the use of one or more thin slips without polishing. The vessel surface is rough. Several new ceramic types are also introduced. The painted designs comprise stylized plant motifs, close-set chevrons and ball-and-stem motif. In Rangpur II B no new ceramic type is introduced and except pellets no new motif is painted, but the painting is carelessly executed. The colour-scheme consists of black-over-red or chocolate-on-buff. But generally the Jhukar ware is thinner than Rangpur II B ware. The geometric patterns of Jhukar do not occur on Rangpur II B vessels. In form, colour-scheme and painted motifs, some of the Jhukar vessels are different from the typical Harappa wares. Rangpur II B vessels, which hardly show any variation from Harappa vessels except in coarseness of fabric and treatment of surface, cannot be considered to represent the Jhukar phase. Neither pottery head-rests nor circular stamp seals of pottery, so characteristic of Jhukar culture, are found in Rangpur II B.

Much has been written on the Cemetery H culture of Harappa and it is not necessary to repeat the arguments here. But a word may be said about the pottery of Cemetery H as compared with the pottery of Rangpur II C and III. In composition, treatment of surface and types the Cemetery H ware and the Lustrous Red Ware are different. The pottery of Cemetery H is made of fine clay and the vessels are well-fired, whereas in Rangpur II C and III the clay is not levigated and the firing is imperfect. Though both the wares are treated with a thick red slip, Rangpur vessels have a lustre which is lacking in Cemetery H vessels. So far as the shapes go, the flask and large storage-jar with carination are found in Cemetery H only. The dishes are flat and have a beaded rim in Rangpur II C, while they have a projected rim in Cemetery H. The large jar with wide mouth and carinated shoulder found in Cemetery H is absent at Rangpur. In the Indian Museum collection of Cemetery H pottery there exists a large bowl with blunt-carinated shoulder and thick walls[1] somewhat similar to the bowls in Rangpur II C. The stylized bull-motif painted on the carinated bowl of Rangpur II C and III is analogous to the motif on Cemetery H jar.[2] The body is indicated by lines and the horns are 'x'-shaped. The muzzle is long. Whereas the eye is clearly shown in Cemetery H bull, it is not clear in Rangpur III. But other painted designs of Cemetery H, geometric and naturalistic, are not noticed on the Lustrous Red Ware. A single motif, such as the bull with 'x'-shaped horn and long muzzle, occurring in Rangpur III may be due to a remote contact between the Lustrous Red Ware and Cemetery H cultures.

The massacre of the residents of Mohenjo-daro is sometimes attributed to the invasion of the Aryans. Hoards of jewellery and other precious objects found in the late strata of the city are said to indicate a disturbed state of affairs, while the hoards of copper tools are said to suggest a feeling of insecurity and the flimsy constructions to indicate a decline in the standard of civic amenities. The industrial slums are considered as a sign of decadence and impending collapse.

In the absence of any substantial material evidence left by the invaders of Mohenjo-daro the invasion is more imaginary than real. On the other hand, there is ample evidence to show that recurring floods played havoc with the dwellings in the city. The inhabitants might not have had time enough to take away their hoarded jewellery or copper tools and weapons while fleeing to escape from destructive floods. In the absence of any stratigraphical evidence stray finds such as a shaft-hole axe or a sword with a mid-rib or a stray burial may not mean much. At the time of evacuation the death of a few hundred

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[1] Vats, *op. cit.* II (1940), pl. LXI, *24.*
[2] *Ibid.*, pl. LXI, *64.*

persons in a large city like Mohenjo-daro is not unexpected. Even with modern equipment people are unable to escape sudden floods and die in hundreds.

SUMMARY.—The evidences in respect of the destruction of the major settlements of the Harappans in the Indus, Ghaggar and Sutlej valleys and in Gujarat may be summarized as follows. At Harappa, Mohenjo-daro, Kalibangan, Rupar, Desalpur, Lothal, Rangpur and Bhagatrav, there is absolutely no evidence of any settlement by people who belonged to a group culturally different from the Harappans and who were directly responsible for the destruction of the former. Even at Harappa there is a gap.[1] On the other hand, there is positive evidence at Lothal, Rangpur, Desalpur, Bhagatrav and Chanhu-daro of the destruction of the Harappan settlements by flood. The débris-layers and eroded platforms at Mohenjo-daro and Harappa may point out similar causes of destruction. The hiatus between the end of the Harappan settlements and the re-occupation of the site by the Painted Grey Ware folk at Rupar and Alamgirpur proves that there was no settlement immediately after the Harappans left the sites. Wherever there was any immediate re-occupation of the site as at Rangpur, Lothal and Bara, it was the Harappans themselves who came back to settle down once again.

M. R. Sahni cites the high hill of silt at Budh-Takkar as evidence of a great flood of long duration in the Indus valley. Similar evidence in the form of a 4-ft. thick deposit of silt over the Harappan occupational débris at Koth near Lothal has already been mentioned (above p. 181). Mackay's remarks regarding the destruction of Chanhu-daro confirm that a flood must have been the cause for it (above, p. 195).

Wherever the duration of the flood was short as at Rangpur, Lothal and Bhagatrav, the Harappans re-occupied the site immediately after the recession of the flood-waters. But Desalpur and the Indus valley sites had to be abandoned owing to the long duration of the flood.

B. CENTRAL INDIA

Bounded on the west by the Aravalli mountains and on the south by the Vindhyas, the plateau region comprising Mewar and Malwa is not easily accessible from Rajasthan and Gujarat except through the Ajmer and Palanpur gaps respectively. With vast fertile delta regions at their disposal the Harappans did not find any need to penetrate into the hills at least in the early stages, when for purposes of trade they moved along the coast. Later on, when they had to leave the Indus valley, they went in search of new lands, though less fertile.

(i) *The Narmada valley*

NAVDATOLI AND MAHESWAR.—The chalcolithic occupation at Navdatoli and Maheswar is characterized by plain and painted pottery, an advanced microlithic industry with parallel-sided blades, mace-heads, sling-stones, copper celts, pins, chisels and hooks and beads of agate and carnelian. Four sub-phases have been distinguished by the excavators.[2] Painted black-and-red ware is noticed in a limited quantity and the cream-slipped ware with a fine section in a fairly large quantity in the early levels. Black-on-red

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[1] Cf. B. B. Lal in *Ancient India*, nos. 10 and 11 (1954 and 1955), p. 151 n.

[2] Sankalia and others, *Excavations at Maheswar and Navdatoli* (Poona 1958); Subbarao, *op. cit.*, pp. 107-11.

painted ware with a coarse section is also limited. In the intermediate levels, the Malwa Ware with a coarse gritty fabric and matt-surface and treated with a thick red slip is the chief ceramic industry. It is painted in black over red. Now the black-and-red ware is not painted and the cream-slipped ware is coarse in fabric but almost negligible in quantity. The simple black-painted red ware of coarse Jorwe fabric (below, p. 203), which is well-fired makes its first appearance in intermediate levels and continues later also. There is a wide variety of form and decoration in the Ware which occurs uniformly in all the Phases. It is in late levels that the Lustrous Red Ware is widespread and more of the Jorwe fabric and types can be seen. The chalcolithic occupation at Navdatoli is dated between 1457 and 1000 B.C. on the basis of carbon-14 dates, and the Lustrous Red Ware occurs around in 1100 B.C.

The affinities between Rangpur and Navdatoli may be summarized here. The black-and-red ware of Rangpur is different in treatment of surface and forms from the black-and-red ware of Navdatoli. The latter is black or grey on the exterior and slightly reddish below the rim on the exterior, whereas in Rangpur II C and III the exterior of the vessels is lustrous red and the interior black and shining. Most of the Rangpur bowls have a carinated shoulder in Periods II C and III. However, only one type, viz. a bowl with a flaring rim, from Navdatoli may be said to have a vague resemblance with a Rangpur bowl of Period II C (fig. 35, p. 104). It is the Lustrous Red Ware that provides an important link between Rangpur and Navdatoli. The carinated bowl and hollow stem of dish-on-stand are two important types common to both the places. The ceramic types of Rangpur III can also be traced in other wares than the Lustrous Red Ware from Navdatoli. A bowl with concavo-convex profile and a jar with a high neck in Malwa fabric and a basin with a clubbed rim in the red ware may be mentioned here (figs. 37 and 38). Of painted motifs, hatched triangles and zigzag lines are noticed on the vessels from Rangpur as well as Navdatoli. It is thus abundantly clear that there was contact between Rangpur II C and III on the one hand and the middle and late phases of Navdatoli III on the other. Some of the ceramic types such as the bowl-on-stand, dish-on-stand and dish with a beaded rim in Navdatoli are similar to those evolved from the Harappa types.

The question that arises is the route taken by the Harappans to reach central India. There are two possibilities. The Harappan refugees moving up the Narmada river from Mehgam could have carried the Lustrous Red Ware. At Hasanpur near Mehgam one can see the evolved Harappa types in the Lustrous Red Ware. Alternatively, the Navdatoli folk might have received it from Kunasutaria etc. in north Gujarat.

Other elements in the chalcolithic culture of Navdatoli may be mentioned here. The stippling of the body of the antelope in Navdatoli is said to remind of a similar treatment in Hissar I C, Sialk III B and Giyan V D. The flying hair of the dancing figures from Navdatoli is said to recall a roughly similar style on the Samarra Ware. Furthermore, the excavators believe that the channelled spout and bowl-on-stand were also introduced from Giyan and Sialk and did not have an Indian origin. It must be pointed out in this connexion that the bowl-on-stand of varying dimensions is found at Harappa, Rupar and Lothal. The Rupar cemetery has yielded a beautifully-painted bowl-on-stand. From Ahar I B comes a bowl-on-stand analogous to the larger bowls and wine-cups of Navdatoli. In this connexion the stemmed bowl of Rangpur II C and III (fig. 45, *140*) evolved in stages may also be mentioned. At Harappa itself several bowls-on-stand were found.[1] An Indian origin may not, therefore, be ruled out.

[1] Wheeler (1947), figs. 11, *If*, and 12, *IId*, *e* and *f*.

(ii) *The Aravalli region*

AHAR.[1]—An important chalcolithic site excavated in Rajasthan is Ahar near Udaipur.

R. C. Agarwala has distinguished here three main phases of occupation. Periods I and II represent a chalcolithic culture, while Period III is of the early historical age assignable to the first three centuries of the Christian era. Period I is noted for two ceramic wares, viz. a coarse grey ware and a black-and-red ware. Other finds include etched carnelian beads, a copper razor and a large thick ear-ring of soapstone (unburnt steatite).

The black-and-red ware occupies a unique place in the ceramic sequence prior to the Northern Black Polished Ware. It is a common ware occurring in varying shapes and quantities at almost all the chalcolithic sites.[2] Certain types are common to the black-and-red ware and micaceous red ware in Gujarat (fig. 44, p. 123). Conversely, the same types of vessels are fired under fully-oxidizing or partially-oxidizing and partially-reducing conditions.

A close examination of the black-and-red wares of Lothal and Ahar reveals a certain difference between the two groups. Except for the technique of inverted firing adopted in both the cases and a vague resemblance in colour, the black-and-red ware of Ahar is different from that of Lothal in shapes, painted designs and treatment of the surface. The fabric of the Lothal black-and-red ware vessels is superior to that of Ahar because of the finer clay used. The bowls from Lothal A are convex-sided and have a slightly incurved or featureless rim, same as the bowls in the Harappa red ware, but in Lothal B they are blunt-carinated as is the case with the red ware (fig. 44). In the early levels of Ahar I the bowls are beaded and in Ahar II they are carinated at the shoulder and are shallow. The painting is confined to the interior of the vessels at Lothal and Rangpur, whereas at Ahar it is limited to the exterior in Period I and extends over both the surfaces in Period II. The observations made in the case of the black-and-red ware of Lothal A and B apply to those from Rangpur II A and II B. It is apparent that both at Rangpur and Lothal some vessels were fired under fully-oxidizing conditions resulting in the red ware, while others with similar shapes were fired under partly-oxidizing and partly-reducing conditions which resulted in the production of the black-and-red ware. It is very interesting to find that the bowl, small jar with a raised neck and bowl with a stud-handle are fired in both the technique at Lothal. The continuous occurrence of the black-and-red bowls with modifications in their shapes closely following the bowls in the modified forms of red ware of Lothal A and B and of Rangpur II A, II B, II C and III is an indication that the types are individualistic to each site and period, whereas the technique is common. Hence, it is only the technique that came to be widely adopted all over India in the chalcolithic period and continued subsequently.

The occurrence of the black-and-red ware at Rangpur and Lothal in the Harappa levels dates back to the third millennium B.C. It is found at Rojdi and Lakhabawal in Kathiawar, at Kot-diji[3] in the Indus valley, Rupar and Bara in the Sutlej valley and Alamgirpur in the Gangetic valley in the Harappan context. But this does not necessarily mean that all these Harappan sites received the black-and-red ware from Ahar. The

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[1] [See. p. 108, n. 3.—Ed.]

[2] The black-and-red ware occurs at Alamgirpur and Hastināpura in the Painted Grey Ware levels.

[3] In the collection of the Prince of Wales Museum, Bombay.

Harappans themselves appear to have known the inverted firing technique long before the Ahar people knew it.

The contemporaneity of Ahar I with Rangpur II C and III is proved by the presence of a few Lustrous Red Ware types in both. The high-necked jar, bowl with a deep-carinated shoulder and splayed rim, basin with a beaded rim and the corrugated stem of dish-on-stand are some of the types found in the red ware in Ahar I and II and Rangpur II C and III. But the Ahar type of black-and-red ware vessels are not found in Lothal A and Rangpur II A and II B, nor are the Harappa red and buff wares or other Harappa objects encountered at Ahar. Hence Ahar does not seem to have been contemporary with Lothal A. The earliest evidence of contact provided may go back to Lothal B. In the absence of typical Harappan objects, such as seals or chert blades or Harappa ceramic types at Ahar, a contact with Rangpur II A cannot be assumed.

(iii) *The Chambal valley*

NAGDA.—The chalcolithic phase of occupation at Nagda on the river Chambal in Madhya Pradesh has been fully explored by N. R. Banerjee.[1] The main ceramic industry is the black-painted red ware. Some of the ceramic types of Nagda I which closely resemble those from Rangpur II C and III are the sharp- and blunt-carinated bowl, corrugated stem of dish-on-stand and the non-carinated dish.

Other types include the jar, lid and basin. The fabric of the vessels is fairly sturdy and some of them have a smooth surface. Painting is executed in light-black over light-red and the designs include running antelopes with wavy horns and hatched diamonds as in Rangpur II C and III, row of dancing figures, peacock and wavy line.[2] There are three other ceramic wares in Nagda I, viz., the black-and-red ware, burnished grey ware and red ware. The main types in the black-and-red ware are convex-sided bowls and flat dishes, but the quantity is very limited. Horizontal lines, strokes, criss-cross and diamond are important designs painted on them. It is, therefore, likely that Rangpur II C and Nagda I established contacts with each other though not directly. The lithic industry of Nagda comprises parallel-sided blades of chalcedony produced in crested guiding ridge technique but rarely retouched. Steatite was known but not faïence. Copper was scarce. Beads of jasper, sandstone and terracotta formed personal ornaments.

OTHER SITES.—In the course of a systematic survey of the triangular plateau-region in south-eastern Rajasthan K. N. Puri and V. D. Krishnaswami discovered a number of chalcolithic sites in the Gambhiri, Berach and Chambal valleys in Udaipur and Chitorgarh Districts. They fall into two distinct groups. The first group yields the black-and-red ware unassociated with microliths.[3] The ceramic ware as such bears a family-likeness to the chalcolithic pottery of Ahar in technique. The second group yields the black-and-red ware as well as microliths. Bhagwanpura, on the Banas river,[4] has yielded the bowl with a flaring rim and convex sides and bowl with an incurved rim and blunt-carinated shoulder. Ahar, Umand, Nangauni and Bansen form a distinct group by themselves, while other sites such as Bhagwanpura form another cultural group with a black-on-red painted ware and a fine grey ware associated with the black-and-red ware. It is the occurrence of the dish with straight sides in fine grey ware of the type found in Hastināpura III which is thought-provoking. Chosla, situated on the confluence of the Khari and Berach rivers has yielded

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[1] I am highly obliged to Shri N. R. Banerjee for the information.
[2] *Indian Archaeology 1955-56—A Review*, figs. 5-7.
[3] *Indian Archaeology 1956-57—A Review*, p. 8 and fig. 3.
[4] *Indian Archaeology 1957-58—A Review*, p. 45 and fig. 22.

the Painted Grey Ware besides the black-painted red and black-and-red wares. It is, therefore, likely that the Painted Grey Ware infiltrated into Mewar through the Banas and Chambal valleys from the Ganga-Yamuna *doāb*.

C. The Deccan

(i) *The Tapti valley*

The southward extension of the Harappa culture down to the Tapti valley and its survival in later times has been mentioned previously (above, p. 191). But another group of chalcolithic sites has also come to notice in the same region. Prakash in Dhulia and Bahal and Tekwada in Jalgaon Districts have a bearing on the present report as certain affinities between the Lustrous Red Ware-using people and the chalcolithic folk of Bahal and Prakash can be traced.

Prakash.—The 70-ft. high mound is situated at the confluence of the rivers Tapti and Gomai. Four cultural Periods were distinguished by B. K. Thapar who excavated the site.[1] We are concerned here with the earliest period, viz. the chalcolithic phase of occupation. As at Nagda, Ahar and Navdatoli, the use of copper was very limited at Prakash. Short parallel-sided blades of chalcedony formed the lithic tools. The black-painted red ware was the chief ceramic industry, the principal types being the jar with cylindrical neck as at Mehgam (above, p. 189), high-necked jar with a beaded rim, sharp-carinated bowl and non-carinated or slightly-carinated dish. It may be recalled here that all these types occur in Rangpur III in the Lustrous Red Ware and coarse red ware. Equally interesting is the occurrence of the painted designs such as panels of hatched diamonds, groups of wavy lines and hatched panels[2] as in the case of the vessels from Lothal B. *Loṭā*-shaped vessels in grey ware resemble those in red ware of Lothal B. Certain affinities between Lothal B and Prakash I are, therefore, evident and need further investigation.

Bahal and Tekwada.—Bahal is situated on the left bank and Tekwada on the right bank of the Girna. Two Sub-phases have been distinguished by M. N. Deshpande in the chalcolithic occupation at Bahal.[3] Phase I A is noted for a thick grey ware, the main type in which is the globular jar with a flared rim as at Brahmagiri. Other types are the bowl with a flat base, storage-jar decorated with incised designs and applied female figures. Mention may also be made of a fine thin grey ware painted in red ochre.

From the point of view of the spread of the Lustrous Red Ware culture Phase I B of Bahal is important. The carinated bowl and jar with lustrous red slip are encountered here. A fine red ware painted in black with hatched diamonds, triangles, wavy lines and foliage-patterns also occurs. Antelope and horse are among the animal-motifs. The Jorwe type of the carinated bowl and spouted vessel and the Lustrous Red Ware types noticed in Bahal I B provide a link between the Lustrous Red Ware culture of Gujarat and the chalcolithic culture of central Deccan. The other components of the chalcolithic culture of Bahal are parallel-sided blades, lunates and trapezes of chalcedony, agate and jasper, beads of terracotta, shell and paste and copper objects in extremely limited quantities.

On the opposite bank of the Girna is Tekwada, where burials belonging to Phase I B of Bahal were found. They were mostly urn-burials of children but the extended burial of an adult was also noticed. The urn-burials were different from those of Nevasa in so far as

[1] I am grateful to Shri B. K. Thapar for the information.

[2] *Indian Archaeology 1954-55—A Review* (New Delhi, 1955), pl. XX B.

[3] I am indebted to Shri M. N. Deshpande for the information.

the pots were not placed one above the other mouth-to-mouth. Secondly, the fabric of the black-and-red ware of the Bahal-Tekwada group is more akin to the megalithic ware than to the black-and-red ware of the Nevasa burials. But we do not as yet know the funerary methods of the post-Harappan chalcolithic folk at Rangpur, Ahar, Nagda and Navdatoli, who may represent fairly distinct groups. Urns of black-and-red ware used in the burials at Tekwada and Nevasa are typologically different from the black-and-red ware vessels associated with the Harappa and Lustrous Red Ware cultures.

(ii) *The Godavari valley*

NEVASA.[1]—An interesting phase of neolithic-chalcolithic culture has been brought to light by H. D. Sankalia at Nevasa. In addition, Early and Middle Stone Age tools are found in the river-section. Period III of Nevasa is noted for plain and painted pottery, microliths, stone celts, steatite beads, sling-stones and celts, Harappan chisel and beads and needles of copper or bronze, representing a chalcolithic occupation with a neolithic substratum. The neolithic elements of this Period are said to have been attested to by the presence of hammer-stones, anvils and stone axes. Houses had floors of gravel and lime and roofs were supported by wooden pillars. The most interesting information is, however, provided by the burials. Adults were buried in fully-extended or slightly-flexed manner in pits or jars placed horizontally. The inhumation of children was fractional in urns. The liberal use of vessels painted in black over a fine red slip may be noted. The main ceramic types are the spouted jar with a flaring neck, bowl, etc. Besides geometric patterns, such as hatched panels and groups of wavy or oblique lines, naturalistic designs were also known. Deer with wavy horns[2] painted in black closely resemble those on the bowls from Rangpur III.[3] A pale brown-and-black ware with a fine glossy black surface treated with a post-firing red wash also occurs. Excepting one, viz., a carinated bowl, there is no type comparable with those of the Rangpur or Lothal in the black-and-red ware. In fabric and surface treatment the black-and-red ware vessels of Nevasa are different from those of the Harappan sites in Gujarat. However, three main points should be remembered in the case of Nevasa. Firstly, it represents a chalcolithic culture wherein the neolithic elements still survive. As one goes farther south, the neolithic features become more pronounced. Secondly, the painted wares of Nevasa III are entirely different from those of Rangpur II C and III in shapes except for a carinated bowl painted with a deer-motif, which itself bears a close resemblance to the deer painted on Rangpur bowls. This may suggest a remote contact between the otherwise two distinct groups of people. Thirdly, whereas in the Tekwada burial, urns are of the black-and-red ware group, there is a marked preference for painted vessels of the black-on-red ware family at Nevasa.

DIAMABAD.—Not far from Nevasa is Diamabad,[4] excavated by M. N. Deshpande, where black-painted red pottery, neolithic stone axes and parallel-sided blades of chalcedony are found in the chalcolithic levels. The neolithic element is stronger at Diamabad than at Nevasa. The chalcolithic elements, especially the parallel-sided blades and painted pottery, are not however insignificant. The first phase is noted for polished stone axes, chalcedony blades and a grey ware. In the second Phase black-on-red painted ware, especially blunt-carinated bowls of Rangpur II C types, spouted vessels, channel-spouts and parallel-sided blades are encountered. This shows a strong chalcolithic bias.

[1] Sankalia and others, *op. cit.* (1960).
[2] *Indian Archaeology 1955-56—A Review*, fig. 1 and pl. XVII.
[3] *Indian Archaeology 1954-55—A Review*, pl. XII B.
[4] *Indian Archaeology 1958-59—A Review*, pp. 15-17.

The third Phase falls into Nasik-Jorwe group with its carinated and spouted vessels. Daimabad was perhaps an outpost of the neolithic, more precisely polished stone axe people, who came in direct contact with the successors of the Harappans in Gujarat.

NASIK AND JORWE.—The chalcolithic folk of Nasik and Jorwe used black-painted red pottery, copper celts, parallel-sided blades and bone pins and arrow-heads. The ceramic types and painted designs belong to a distinct group. The long spouted vessel, carinated jar and concavo-convex-sided bowl are common types. Painting is executed in black over red directly on the vessel-surface, mostly in oblique lines. Naturalistic designs are very few. Considering the composition, treatment of surface, painted designs and shapes of vessels, Nevasa, Nasik and Jorwe belong to one group. The main elements of this culture group, viz., the parallel-sided blades and painted ware, extend into the Tapti valley, where the chalcolithic settlements, such as Bahal and Prakash, show a greater diversity in the painted designs as a result of the contact they had with the Lustrous Red Ware culture. Further north, the chalcolithic sites such as Bhagatrav, Mehgam, Telod and Hasanpur show a strong Harappan affinity even as late as the first mellennium B.C. Thus, the ceramic types and painted designs of the Nevasa-Nasik-Jorwe group become less and less popular in the Tapti valley and Narmada estuary.

(iii) *The Krishna-Tungabhadra valley*

Three sites in the Deccan plateau, viz., Maski,[1] Brahmagiri[2] and Sanganakallu,[3] show a chalcolithic affinity with a strong neolithic substratum. The chalcolithic phases of these sites are characterized by the use of polished stone axes, parallel-sided blades and copper objects in extremely limited numbers. Metal was very scarce and stone blades and axes still formed the main implements. The painted vessels are crude and limited in number. At Maski they are painted in black or chocolate over an ochrous slip. At Brahmagiri post-firing painting is noticed, but, on the whole, the painted pottery is so insignificant that it does not form one of the main elements of the culture-complex. But for the presence of a couple of copper objects and painted sherds, Period I of Brahmagiri is essentially of the stone axe culture. Both Sanganakallu II and Brahmagiri I, with traces of chalcolithic intrusion, are assigned to 1000 B.C. But Utnur and Piklihal, both of which show contact with chalcolithic cultures, are dated 2000 B.C. Steatite disk beads, painted sherds and copper objects have been found, besides chert blades. A particular point of interest at Maski and Brahmagiri is the occurrence of chert blades, more or less similar to the Harappan blades, though the perfection of the latter is not noticeable at either of the southern Deccan sites. But the very fact that the crested guiding ridge technique was adopted shows that the technique travelled as far south as Brahmagiri. The occurrence of the double pot of identical shapes in Rangpur II C, Maski I, Jorwe I and Kot-diji may also be noted (pl. L B).

5. CONCLUSION

The excavation at Rangpur and explorations in Gujarat have thus added a new chapter to the history of India by extending the zone of the Harappa civilization far south of the Indus estuary and adducing fresh archaeological evidence regarding the survival of the Harappa culture for half a millennium years more in a rather decadent form. Sufficient material evidence has been obtained from Rangpur, Lothal and other Harappa

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[1] *Ancient India*, no. 13 (1957), pp. 4-142.

[2] *Ibid.*, no. 4 (1947-48), pp. 180-310.

[3] B. Subbarao, *The Stone Age Cultures of Bellary* (Poona, 1948).

sites in Gujarat to enable us to draw certain broad conclusions regarding the expansion, survival, degeneration and transformation of the Harappa culture in west India.

The excavation at Rangpur has removed the last lingering doubt regarding the southward extension of the Harappa culture, the traces of which have been found even at Bhagatrav in the Tapti valley. It can now be said with certainty that the Harappans came to Lothal for trade or colonization purposes in 2450 B.C. and developed the village into a large trading-centre by 2000 B.C., when part of the population moved towards Rangpur on the one hand and Bhagatrav on the other. During the glorious days of their culture even a small settlement like the one at Rangpur had an excellent drainage-system, a uniform standard of weights and comfortable houses. Extensive trade helped them to obtain raw material, such as copper ingots, from distant places including the Sumerian cities. They also exported raw material and finished products, such as stone beads, shell and ivory. However, in spite of the measures adopted against recurring floods most of their settlements were destroyed by great floods in *circa* 1500 B.C. Rangpur and Lothal have revealed the subsequent story according to which the Harappans did not suddenly disappear from the Indian scene. The ceramic and other evidences from Rangpur II B and Lothal B show that the Harappans re-occupied the sites after the recession of the floods and continued to live there for more than five centuries in a poorer condition. Foreign trade received a set-back and imports also suffered. The adverse economic condition was responsible for the great decline in standards of construction and poor material equipment, including ceramic wares. A gradual evolution in cermaic forms is noticeable. Beakers, goblets and terracotta bangles were slowly discarded and steatite disk beads and chert blades had become scarce. Sanitary arrangements in the village were very poor. People lived in jerry-built houses both at Lothal and Rangpur in the post-flood days. With the influx of the refugees from the Indus valley a number of small temporary settlements sprang up along the coast. In course of time they moved towards the interior. Most of the late Harappan settlements are found to be small in size and the occupation-débris is not more than 5 to 6 ft. in depth. A few settlements developed into small towns a few centuries later, among them being Rangpur, Devaliyo and Adkot. The very vitality of their culture helped the Harappans to rehabilitate themselves but not without adjustments necessitated by new circumstances. For example, while continuing some of the earlier ceramic forms they evolved also new ones. The poor fabric of the vessel was made good by the lustre produced on the surface. But fewer and less sophisticated designs, some of which were stylized, were painted on a limited surface in the Transition Phase. The inhabitants were satisfied with terracotta beads in place of those made from imported steatite and semi-precious stones, but the shapes continued to be Harappan. By stages the Harappa culture transformed itself into the Lustrous Red Ware culture in Gujarat in the last quarter of the second millennium B.C.

Rangpur has also helped to arrive at a continuous cultural sequence from 2000 B.C. to 800 B.C., thus narrowing the gap in the history of western India. Incidentally, it has provided a lower limit to the pre-pottery geometric microlithic industry and has brought to light the circumstances under which most of the Harappan settlements were destroyed by 1500 B.C.

An intensive survey of Gujarat resulting in the discovery of several Harappan and Late Harappan sites has gone a long way in tracing the horizontal expansion of the Harappa culture, whereas the excavations at Rangpur and Lothal give a clue to its vertical extent.

It has been possible to trace some of the missing links between various chalcolithic cultures of Gujarat, central India and the Deccan and to explain the survival of Harappan traditions in regions far removed from the Indus valley.

APPENDIX

LIST OF SITES OF HARAPPA AND ALLIED CULTURES IN GUJARAT[1]

SL. NO.	NAME OF SITE	NEAREST VILLAGE	TALUKA OR MAHAL	DISTRICT	LAT. N.	LONG. E.	PERIOD (RANGPUR SEQUENCE)
1	Adatala	Adatala	Gadhada	Bhavnagar	21° 58′	71° 37′	II B
2	Adkot	Adkot	Jasdan	Rajkot	22° 00′	71° 05′	II B & II C
3	Ajamer	Udepur	Morvi	Rajkot	22° 40′	70° 50′	II C
4	Akru	Akru	Dhandhuka	Ahmadabad	22° 15′	71° 55′	II B & II C
5	Alia-Bada	Alia-Bada	Jamnagar	Jamnagar	22° 27′	70° 13′	II B & II C
6	Alau	Alau	Dhandhuka	Ahmadabad	22° 15′	71° 30′	II B & II C
7	Amra	Amra	Jamnagar	Jamnagar	22° 26′	69° 56′	II B
8	Ardoi	Ardoi	Kotdasan-gani	Rajkot	22° 05′	70° 47′	II C
9	Babarkot	Babarkot	Sayala	Surendra-nagar	22° 15′	71° 30′	II B & II C
10	Bed	Bed	Jamnagar	Jamnagar	22° 26′	69° 57′	II C
11	Belora	Jhanjhmer	Dhoraji	Rajkot	21° 47′	71° 46′	II B & II C
12	Bhagatrav	Jetpur	Hansot	Broach	21° 29′	72° 42′	II A & IIB
13	Bhalgam	Baldoi	Gondal	Rajkot	22° 02′	71° 05′	II B
14	Bhamakdal	Sultanpur	Kunkavav-vadia	Amreli	21° 45′	70° 50′	II B
15	Bhangor	Bhangor	Bhanwar	Jamnagar	22° 05′	69° 52′	II C & III
16	Binanagari	Balamba	Jodiya	Jamnagar	23° 43′	70° 22′	II C
17	Bodiyo	Devlia-Mota	Babra	Amreli	21° 49′	71° 06′	II B & II C
18	Chachana	Chachana	Limbdi	Surendra-nagar	22° 25′	71° 50′	II B
19	Charanio	Samadhiala	Umrala	Bhavnagar	21° 55′	71° 32′	II B & II C
20	Daidungri	Adkot	Jasdan	Rajkot	22° 00′	71° 05′	II C & III
21	Devdhar	Kundni	Jasdan	Rajkot	22° 07′	71° 09′	II B & II C
22	Devaliyo	Barvala	Lathi	Amreli	21° 52′	71° 25′	II C & III
23	Desalpur	Desalpur	Nakhtrana	Bhuj	23° 40′	69° 10′	II A
24	Dhankanio	Khilori	Kunkavav-vadia	Amreli	21° 45′	70° 55′	II B & II C
25	Dhrosan	Nawagam	Kodinar	Amreli	20° 50′	70° 30′	II B
26	Dhulkot	Una	Una	Junagadh	20° 50′	71° 02′	II B & II C
27	Dungarpur	Gadharia	Jasdan	Rajkot	22° 03′	71° 13′	II C
28	Ghorwada	Dhurasia	Gondal	Rajkot	20° 45′	70° 50′	II B & II C
29	Godhapadar	Halenda	Rajkot	Rajkot	22° 05′	71° 03′	II B & II C
30	Gop	Gop	Jamjodhpur	Jamnagar	22° 01′	69° 56′	II B & II C
31	Hariana	Hariana	Jodiya	Jamnagar	22° 36′	70° 15′	II B
32	Hasanpur	Hasanpur	Hansot	Broach	21° 15′	72° 45′	II C & III
33	Holivalo	Lakhanka	Gadhada	Bhavnagar	21° 57′	71° 40′	III
34	Jaidak	Rasnal	Jodiya	Jamnagar	22° 40′	70° 35′	II B & II C
35	Jivani-no-dhoro	Vangadhra	Umrala	Bhavnagar	21° 50′	71° 45′	II C & III
36	Kaj	Kaj	Kodinar	Amreli	20° 44′	70° 51′	II B

[1] Besides the sites discovered by the author, some of those located by Shri P. P. Pandya and Shri J. M. Nanavati are also included.

APPENDIX (*contd.*)

SL. NO.	NAME OF SITE	NEAREST VILLAGE	TALUKA OR MAHAL	DISTRICT	LAT. N.	LONG. E.	PERIOD (RANGPUR SEQUENCE)
37	Kalapan	Khatli	Kandorna	Rajkot	21° 55′	70° 20′	II B & II C
38	Kalianpur	Kalianpur	Kalianpur	Jamnagar	21° 50′	69° 25′	II B & II C
39	Kanasutaria	Chhabasar	Dholka	Ahmadabad	22° 47′	72° 16′	II C & III
40	Kanjetar	Kodinar	Kodinar	Amreli	20° 45′	70° 40′	II B & II C
41	Kerali	Kerali	Jetpur	Rajkot	21° 00′	70° 20′	II C
42	Kerlavlo	Rajpipla	Gadhada	Bhavnagar	21° 52′	71° 38′	II C
43	Khambho-dhar	Khambho-dhar	Porbandar	Junagadh	21° 45′	69° 35′	II B & II C
44	Khetarvalo	Adatala	Gadhada	Bhavnagar	21° 58′	71° 37′	II C & III
45	Khodiyar	Dantrad	Talaja	Bhavnagar	21° 24′	71° 09′	II B & II C
46	Kindarkhera	Kindarkhera	Porbandar	Junagadh	21° 48′	69° 33′	II B & II C
47	Koba	Dhurasia	Gondal	Rajkot	20° 45′	70° 50′	II C
48	Kota	Kota	Khambha-liya	Jamnagar	22° 10′	69° 42′	II B & II C
49	Kotada	Kalavad	Kalavad	Jamnagar	22° 12′	70° 22′	II B
50	Koth	Koth	Dholka	Ahmedabad	22° 38′	72° 18′	II A & II B
51	Kundanpur	Parevala	Jasdan	Rajkot	22° 05′	71° 10′	II B & II C
52	Lakhavav	Junvadar	Lathi	Amreli	21° 51′	71° 27′	II C & III
53	Lakhabawal	Lakhabawal	Jamnagar	Jamnagar	22° 24′	70° 00′	II B & II C
54	Lothal	Saragwala	Dholka	Ahmadabad	22° 31′	72° 15′	II A II B & II C
55	Luna	Luna	Nakhtrana	Bhuj	23° 40′	69° 15′	II B
56	Machiala-Mota	Machiala-Mota	Amreli	Amreli	21° 41′	71° 14′	III
57	Madhi	Sultanpur	Kunkavav vadia	Amreli	21° 45′	70° 50′	II C & III
58	Madeva	Dared	Babra	Amreli	21° 50′	71° 24′	II B & II C
59	Makvana	Lakhanka	Gadhada	Bhavnagar	21° 57′	71° 40′	II B
60	Mehgam	Mehgam	Anklesvar	Broach	21° 42′	72° 45′	II B & II C
61	Mora	Mora	Jamnagar	Jamnagar	22° 26′	70° 13′	II B & II C
62	Morpur	Morpur	Khambha-liya	Jamnagar	22° 16′	69° 49′	III
63	Narmana	Narmana	Jamjodhpur	Jamnagar	22° 15′	70° 09′	II B
64	Navinal	Navinal	Mandvi	Bhuj	22° 50′	69° 35′	II B
65	Pansina	Pansina	Limbdi	Surendra-nagar	22° 30′	71° 55′	II B & II C
66	Pasegam	Rajpipla	Gadhada	Bhavnagar	21° 52′	71° 38′	II C
67	Phala	Phala	Jamnagar	Jamnagar	22° 31′	70° 18′	II B
68	Pitar	Pitar	Jodiya	Jamnagar	22° 41′	70° 32′	II B & II C
69	Pitaria	Pitaria	Jetpur	Rajkot	21° 35′	70° 55′	II B & II C
70	Prabhas	Veraval	Patan-Veraval	Junagadh	20° 53′	70° 22′	II B II C & III
71	Randalio	Radhal-na-Dadva	Kalianpur	Jamnagar	21° 49′	71° 03′	II B
72	Rangpur	Rangpur	Limbdi	Surendra-nagar	22° 20′	71° 55′	II A, II B, II C & III
73	Ranigam	Dared	Vallabhipur	Bhavnagar	21° 58′	71° 45′	II B
74	Ranparda	Ranparda	Kalianpur	Jamnagar	21° 15′	69° 40′	II B & II C
75	Rojdi	Rojdi	Gondal	Rajkot	21° 15′	70° 50′	II B & II C

APPENDIX (*contd.*)

SL. NO.	NAME OF SITE	NEAREST VILLAGE	TALUKA OR MAHAL	DISTRICT	LAT. N.	LONG. E.	PERIOD (RANGPUR SEQUENCE)
76	Sanalo	Jasapur	Kalavad	Jamnagar	22° 12′	70° 25′	II C & III
77	Shrinagar	Porbandar	Porbandar	Junagadh	21° 35′	69° 34′	II B & II C
78	Sujnipur	Sujnipur	Patan	Mehsana	22° 53′	72° 09′	III
79	Sultanpur	Sultanpur	Kunkavav-vadia	Amreli	21° 45′	70° 50′	II C
80	Tankaria	Tankaria	Kalianpur	Jamnagar	21° 45′	69° 35′	II B & II C
81	Telod	Hansot	Hansot	Broach	21° 42′	72° 46′	II B
82	Tetariyo	Devlia-Mota	Babra	Amreil	21° 49′	71° 06′	II B & II C
83	Todio	Kothara	Lakhapat	Bhuj	23° 05′	68° 55′	II B
84	Vaharvo	Vangadhra	Umrala	Bhavnagar	21° 50′	71° 45′	II C
85	Vaniavadar	Vaniavadar	Amreli	Amreli	21° 39′	71° 09′	II B & II C
86	Vankiner	Chandrawad	Kalianpur	Jamnagar	21° 50′	69° 25′	II B & II C
87	Virpur	Virpur	Jamnagar	Jamnagar	22° 07′	70° 06′	II C & III
88	Wasai	Wasai	Jamnagar	Jamnagar	22° 24′	70° 00′	II C